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Divisions 10 through 14

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**U.S. ARMY ENGINEER DISTRICT, SAVANNAH
CORPS OF ENGINEERS
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SAVANNAH, GEORGIA 31401-3640**

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SECTION 10100A

VISUAL COMMUNICATIONS SPECIALTIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1	(1984; R 1994) Performance Specifications and Methods of Testing for Safety Glazing Materials Used In Buildings
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C 1048	(1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM F 148	(1995) Binder Durability of Cork Composition Gasket Materials
ASTM F 152	(1995) Tension Testing of Nonmetallic Gasket Materials
ASTM F 793	(1998) Standard Classification of Wallcovering by Durability Characteristics

1.2 GENERAL REQUIREMENTS

The term visual display board when used herein includes, marker boards, tackboards, and board case for SmartBoard. Visual display boards shall be from manufacturer's standard product line. This section also includes requirements for projection screens.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Visual Display Boards

Manufacturer's descriptive data and catalog cuts.
Manufacturer's installation instructions, and cleaning and maintenance instructions.

SD-04 Samples

Aluminum

Sections of frame and chalktray.

Porcelain Enamel

Section showing porcelain enamel coating, steel, core material and backing.

Materials

Section of core material showing the natural cork. Sample of hardwood. Samples shall be minimum 100 by 100 mm and show range of color.

07 Certificates

Visual Display Boards

Certificate of compliance signed by Contractor attesting that visual display boards conform to the requirements specified.

SD-10 Operation and Maintenance Data

Projection screen

1.4 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered to the building site in the manufacturer's original unopened containers and shall be stored in a clean dry area with temperature maintained above 10 degrees C. Materials shall be stacked according to manufacturer's recommendations. Visual display boards shall be allowed to acclimate to the building temperature for 24 hours prior to installation.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Porcelain Enamel

Marker board writing surface shall be composed of porcelain enamel fused to a nominal 0.378 mm (28 gauge) thick steel, laminated to a minimum 6 mm thick core material with a steel or foil backing sheet. Writing surface shall be capable of supporting paper by means of magnets. Marker board surface for display track system may be a powder paint dry erase surface adhered to a nominal 1.214 mm (18 gauge) thick steel.

2.1.2 Cork

Cork shall be a continuous resilient sheet made from soft, clean, granulated cork relatively free from hardback and dust and bonded with a binder suitable for the purpose intended. The wearing surface shall be free from streaks, spots, cracks or other imperfections that would impair its usefulness or appearance. The material shall be seasoned, and a clean cut made not less than 13 mm from the edge shall show no evidence of soft sticky binder.

2.1.2.1 Natural Cork

Material shall be a single layer of pure grain natural cork without backing or facing. The color shall be light tan. The cork sheet shall have a tensile strength of not less than 275 kPa when tested in accordance with ASTM F 152.

2.1.3 Aluminum

Aluminum frame extrusions shall be alloy 6063-T5 or 6063-T6, conform to ASTM B 221M, and be a minimum 1.5 mm thick. Exposed aluminum shall have an anodized, satin finish. Straight, single lengths shall be used wherever possible. Joints shall be kept to a minimum. Corners shall be mitered and shall have a hairline closure.

2.1.4 Hardwood

Exposed hardwood for cabinets shall be oak. Hardwood shall be provided with a durable factory-applied stain and lacquer finish of a type standard with the manufacturer.

2.2 PRESENTATION BOARD

The presentation board shall be a wall hung cabinet with lockable double doors and shall provide the required space for the Government Furnished SmartBoard. The doors shall be attached to cabinet with piano hinges and have a catch or closure to keep doors closed when not in use. The interior

of the cabinet shall contain a flip chart that can be hung on an interior door panel, and tacksurface on the interior door panels. The cabinet shall be oak hardwood. The edge detailing shall be bullnose or radius. Two keys shall be provided for each unit. The size shall be as shown in the drawings.

2.3 MARKERBOARD

Markerboard shall have a porcelain enamel writing surface and a chalktray. Markerboard shall be a factory assembled unit complete in one piece, without joints whenever possible. When markerboard dimensions require delivery in separate sections, components shall be prefit at the factory, disassembled for delivery and jointed at the site. Frame shall be aluminum. Chalktray shall be the same material as the frame. Dry erase markings shall be removable with a felt eraser or dry cloth without ghosting. Each unit shall come complete with an eraser and four different color compatible dry erase markers. The size shall be as shown in the drawings.

2.4 TACKBOARDS

2.4.1 Cork

Tackboard shall consist of a minimum 6 mm thick colored cork with burlap backing laminated to a minimum 6 mm thick hardboard, and shall have an aluminum frame. The size shall be as shown in the drawings.

2.5 PROJECTION SCREEN

Ceiling mounted motorized projection screen shall have 120V motor that is lubricated for life, quick reversal type, has overload protector, integral gears, and preset accessible limit switches. Recessed mount projection screens shall have an operable closure door and access panel. Screen shall be flame retardant, mildew resistant, and a high contrast front viewing surface, with excellent resolution and high grain, with black masking borders. Each side of surface to have tab-guide cable system for even lateral tension and flat surface. Bottom of screen fabric shall be weighted with metal rod. Roller shall be a rigid metal at least 75 mm in diameter mounted on sound absorbing supports. Motor will be motor-in-roller design. Screen shall have a 3 position control switch to stop or reverse screen at any point. The switch shall be installed in a flush electrical box with cover plate, location(s) as shown on the electrical drawings. All conduit and wiring from the control switch to the projection screen shall be furnished and installed by the Contractor. Ceiling recessed case shall be extruded aluminum. Screen shall be UL listed. The size shall be 3750 mm diagonal length.

PART 3 EXECUTION

3.1 INSTALLATION

Installation and assembly shall be in accordance with manufacturer's printed instructions. Concealed fasteners shall be used. Visual display boards shall be attached to the walls with suitable devices to anchor each

unit. The Contractor shall furnish and install trim items, accessories and miscellaneous items in total, including but not limited to hardware, grounds, clips, backing materials, adhesives, brackets, and anchorages incidental to or necessary for a sound, secure, complete and finished installation. Installation shall not be initiated until completion of room painting and finishing operations. Visual display boards shall be installed in locations and at mounting heights indicated. Visual display boards shall be installed level and plumb, and if applicable doors shall be aligned and hardware shall be adjusted. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

3.2 CLEANING

Writing surfaces shall be cleaned in accordance with manufacturer's instructions.

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TOILET PARTITIONS

07/98

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SECTION 10160A

TOILET PARTITIONS

07/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the referenced publications shall be used.

ARCHITECTURAL & TRANSPORTATION BARRIERS COMPLIANCE BOARD (ATBCB)

ATBCB ADA Title III	Americans with Disabilities Act - Buildings and Facilities
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COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-60003	Partitions, Toilet, Complete
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01330, "Submittal Procedures".

SD-02 Shop Drawings

Detail Drawings

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mounting, and anchorings.

SD-03 Product Data

Toilet Partition System

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

SD-04 Samples

Toilet Partition System

Manufacturer's standard color charts and color samples.

SD-10 Operation and Maintenance Data

Toilet Partition System

1.3 SYSTEM DESCRIPTION

Toilet partition system, including toilet enclosures, room entrance screens, and urinal screens, shall be a complete and usable system of panels, hardware, and support components. The partition system shall be provided by a single manufacturer and shall be a standard product as shown in the most recent catalog data. The partition system shall be as shown on the approved detail drawings.

1.4 DELIVERY, STORAGE AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated; free from dust, water, or other contaminants; and shall have easy access for inspection and handling.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to CID A-A-6003, Type I, Style floor supported and overhead braced. Width, length, and height of toilet enclosures shall be as shown. Finish surface of panels shall be high pressure plastic laminate with stainless steel edges. Panels indicated to receive toilet paper holders or grab bars as specified in Section 10800 TOILET ACCESSORIES, shall be prepared for mounting of the items required.

2.2 URINAL SCREENS

Urinal screens shall conform to CID A-A-6003, Type II, Style floor supported. Finish surface of screens shall be high pressure plastic laminate. Width and height of urinal screens shall be as shown.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by toggle-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work.

3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 5 mm and shall rest open at approximately 30 degrees when unlatched. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage until accepted.

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CUBICLE TRACK AND HARDWARE

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SECTION 10191

CUBICLE TRACK AND HARDWARE

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA 45 (1980) Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221M (1996) Aluminum and Aluminum-Alloy
Extruded Bars, Rods, Wire, Profiles, and
Tubes (Metric)

ASTM B 456 (1995) Electrodeposited Coatings of Copper
Plus Nickel Plus Chromium and Nickel Plus
Chromium

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Track layout

SD-08 Manufacturer's Instructions

Track installation

SD-10 Operation and Maintenance Data

Track system, Data Package 1

1.3 DRAWING REQUIREMENTS

Submit track layout drawings. Include suspended track installation details, and overlay drawing showing other trades installation within area.

1.4 DELIVERY AND STORAGE

Deliver tracks to site in unopened containers clearly labeled with manufacturer's name and contents. Store in safe, dry, and clean location. Do not open containers until contents are to be installed.

1.5 QUALITY CONTROL

Allow smooth, rapid, and complete screening with no gaps at corners or ends of track. Form corner bends in a single continuous piece on a 300 mm radius to exactly 90 degrees. Track lengths to 4800 mm shall have no joints.

PART 2 PRODUCTS

2.1 CUBICLE TRACK SYSTEM

Heavy-duty type, hanger mounted. Bends shall be minimum 450 mm radius.

2.1.1 Extruded Aluminum Tracks

ASTM B 221M and ASTM B 456; alloy 6063-TS, channel shape minimum 32 mm wide by 29 mm deep, 1.50 mm minimum wall thickness. Inside raceway to be smooth for interior carriers and must be able to receive a double coated wheel carrier with hook. Finish as designated for aluminum finishes in AA 45.

2.2 CARRIER UNIT

Silent type with double canted wheel carrier. Wheels shall have nylon on stainless steel, chromium plated steel hooks, with swivel to support the curtain. Carriers shall be removable only through access aperture or through end-cap that provides room for insertion or removal of carrier. Provide 2.2 carriers for every 300 mm of track length, plus one additional carrier. Provide a safety loading unit at one end of the channel track consisting of a section of channel track equipped with a hinge and end latch to permit lowering for installation of or removal of curtains from hooks without the use of a step-ladder and without removing carriers from track. Rivet moveable end of safety loading unit to the hinge. Latch end of safety loading unit with a double locking fail-proof locking device for safety. Safety loading unit to be 1200 mm in length of a 2400 mm ceiling installation so latch end lowers to 1200 mm from floor. Length of safety loading unit to be increased according to ceiling height. Provide a key wand for every 20 units. Provide beaded chain curtain drops, 150 mm long; nickel plated steel, with aluminum hook.

2.3 END STOP AND PULL-OUT

Fabricate from aluminum or nylon with an anodized finish matching the track finish.

2.4 FASTENERS

Stainless steel.

2.5 FINISH

Satin, clear anodized.

PART 3 EXECUTION

3.1 INSTALLATION

Verify dimensions prior to installation. Install cubicle track after painting and finishing operations are complete. Provide labor and all materials indicated, specified or necessary for a complete finished installation. Install track plumb, level and true, and securely anchored to the ceiling to form a neat, rigid installation. Remove damaged or defective components and replace with new components.

3.1.1 Installation Details

Install heavy-duty tracks suspended from hangers. Install tracks where indicated. Install carrier units at 150 mm on center maximum. Install end cap at each end of the track and pull-out at the end where curtains are stacked to permit insertion and removal of carrier units. Securely fasten end stops to prevent their being forced out by striking weight of carrier units.

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09/99

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SECTION 10201

METAL WALL LOUVERS

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest versions of the referenced publications shall be used.

THE ALUMINUM ASSOCIATION, INCORPORATED (AA)

AA 45 Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 603.8 Pigmented Organic Coatings on Extruded Aluminum

AIR MOVEMENT AND CONTROL ASSOCIATION, INC. (AMCA)

AMCA 500 Louvers, Dampers and Shutters

AMCA 511 Certified Ratings Program for Air Control Devices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM B 209M Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM B 209 Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221M Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM B 221 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Wall louvers

Show all information necessary for fabrication and installation of louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

SD-04 Samples

Wall louvers

Colors of finishes shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum Sheet

ASTM B 209M, alloy 3003 or 5005 with temper as required for forming.

2.1.2 Extruded Aluminum

ASTM B 221M, alloy 6063-T5 or -T52.

2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than indicated on Structural Drawings. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500 and AMCA 511. The rating shall show a water penetration of 0.06 kilograms or less per square meter of free area at a free velocity of 244 meters per minute. The louvers shall have a free area of 50 percent.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 2 mm.

2.2.2 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions for all louvers more than 1500 mm in width at not more than 1500 mm on centers. Provide mullion

covers on both faces of joints between louvers.

2.2.3 Screens and Frames

For aluminum louvers, provide 12.5 mm square mesh, 1.8 or 1.5 mm aluminum or 6 mm square mesh, 1.5 mm aluminum bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers. Provide other accessories as required for complete and proper installation.

2.4 FINISHES

2.4.1 Aluminum

Provide factory-applied organic coating.

2.4.1.1 Organic Coating

Clean and prime exposed aluminum surfaces and apply a baked enamel finish conforming to AAMA 603.8, 0.02 mm minimum dry film thickness, color as indicated on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.2 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.2.3 Wood

Paint wood or other absorptive materials that may become repeatedly wet and

in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

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SECTION 10270A

RAISED FLOOR SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The latest versions of referenced publications shall be used.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1999) Particleboard Mat formatted Woods

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84 Surface Burning Characteristics of Building Materials

ASTM E 648 Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CEILINGS AND INTERIOR SYSTEMS CONTRACTORS ASSOCIATION (CISCA)

CISCA Access Floors Recommended Test Procedures for Access Floors

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 Voluntary Product Standard - Construction and Industrial Plywood

FEDERAL SPECIFICATIONS (FS)

FS SS-T-312 Tile, Floor: Asphalt, Rubber, Vinyl, and Vinyl Composition

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO Bldg Code Uniform Building Code (3 Vol.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 High-Pressure Decorative Laminates

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

When the space below the finished floor is to be an air plenum, air leakage through the joints between panels and around the perimeter of the floor system shall not exceed 0.15 L/s of air per linear meter of joint subjected to 2.5 mm, water gauge, positive pressure in the plenum.

1.2.6 Grounding

The raised floor system shall be grounded for safety hazard and static suppression.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Raised Floor System

Drawings showing layout of the work, sizes and details of components, details at floor perimeter, bracing to resist seismic or other lateral loads, typical cutout details including size and shape limitation, method of grounding, description of shop coating, and installation height above structural floor.

SD-03 Product Data

Raised Floor System

Manufacturer's descriptive data, catalog cuts, and installation instructions. The data shall include information about any design and production techniques, procedures and policies used to conserve energy, reduce material, improve waste management or incorporate green building/recycled products into the manufacturer of their components or products. Cleaning and maintenance instructions shall be included. Design calculations which demonstrate that the proposed floor system meets requirements for seismic loading, prepared in accordance with subparagraph Underfloor Bracing under paragraph PANEL SUPPORT SYSTEM and ICBO Bldg Code. Certified copies of test reports may be submitted in lieu of calculations.

SD-04 Samples

Raised Floor System

One sample of each panel type and suspension system proposed for use.

SD-06 Test Reports

Tests

Testing of Electrical Resistance

Certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

SD-07 Certificates

Raised Floor System

Certificate of compliance attesting that the raised floor system meets specification requirements.

SD-10 Operation and Maintenance Data

Raised Floor System

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be stored in original protective packaging in a safe, dry, and clean location and shall be handled in a manner to prevent damage. Panels shall be stored at temperatures between 4 and 32 degrees C, and between 20 percent and 70 percent humidity.

1.5 EXTRA MATERIALS

Spare floor panels, spare complete pedestal assemblies, and spare stringers shall be furnished at the rate of one assembly for each 100 or fraction thereof required.

1.6 OPERATION AND MAINTENANCE MANUALS

Provide maintenance instructions for proper care of the floor panel surface. When conductive flooring is specified, require submittal of maintenance instructions to identify special cleaning and maintenance requirements to maintain "conductivity" properties of the panel finish.

PART 2 PRODUCTS

2.1 FLOOR PANELS

2.1.1 Panel Construction

Except for edge panels, panel size shall be 600 by 600 mm. Finished panels shall be within a 0.25 mm tolerance of the nominal size, and shall be square within a tolerance of 0.38 mm measured corner-to-corner. The top surface of panels shall be flat within a 0.51 mm tolerance measured corner-to-corner. Panels shall be permanently marked to indicate load rating and model number.

2.1.1.1 Metal-Clad Cementitious Fill Panel (Composite Panels)

Composite panels shall be of die-formed steel construction totally

enclosing the panel, including the top surface. The void spaces between the top sheet and the formed steel bottom sheet shall be completely filled with an incombustible cementitious or concrete material.

2.1.2 Floor Covering

Floor panels shall be surfaced with materials firmly bonded in place with waterproof adhesive. The electrical resistance shall remain stable over the life expectancy of the floor covering. Any antistatic agent used in the manufacturing process shall be an integral part of the material, and shall not be surface applied. Bolt heads or similar attachments shall not rise above the traffic surface.

2.1.2.1 Vinyl Composition Tile (Computer Room, Data Closet)

Vinyl composition tile surfacing shall be 3 mm thick conforming to FS SS-T-312, Type IV, Composition 1. Tiles may be approximately 300 mm square or may be the full size of the panel.

2.1.2.2 Carpet (In Training Room)

Carpet surfacing shall be field installed using one full carpet square per panel. Carpet shall be nylon filament, loop pile, minimum 0.8 kg/square m, minimum density 4000, and without cushion. Carpet shall conform to ASTM E 648 with a minimum average critical radiant flux of 0.25 watts per square centimeter. Static control shall be less than 2.0 kV at 20 percent relative humidity at 21 degrees C.

2.1.3 Electrical and Data Receptacles

Provide UL listed access floor outlet boxes in locations shown on the electrical drawings. High capacity 286 mm square service outlet boxes shall be capable of accommodating four duplex receptacles, six individual voice/data termination points or four individual voice/data termination points and one grommet opening. The service outlet box shall be a drop-in design having a hinged Lexan lid with carpet or tile insert and Lexan frame with tapered edge. Service outlet box shall be capable of withstanding without failure a load of 362 kg. The floor boxes shall be relocatable by disconnecting the whip end of the power extender cable and moving the box to a new location and reconnecting. Provide power extender cables to interface with the power distribution layout indicated on the electrical drawings.

2.1.4 Resilient Base

Base shall be manufacturers standard rubber (installed with carpet; coved style (installed with resilient flooring). Base shall be 100 mm high and a minimum 3 mm thick. Preformed outside corners shall be furnished.

2.1.5 Lifting Device

Each individual room shall be provided with one floor panel lifting device standard with the floor manufacturer. A minimum of two devices shall be furnished.

2.2 PANEL SUPPORT SYSTEM

2.2.1 Pedestals

Pedestals shall be of steel or aluminum or a combination thereof. Ferrous materials shall have a factory-applied corrosion-resistant finish. Pedestal base plates shall provide a minimum of 10,300 square millimeter of bearing surface and shall be a minimum of 3 mm thick. Pedestal shafts shall be threaded to permit height adjustment within a range of approximately 50 mm, to permit overall floor adjustment within plus or minus 2.5 mm of the required elevation, and to permit leveling of the finished floor surface within 1.56 mm in 3000 mm in all directions. Locking devices shall be provided to positively lock the final pedestal vertical adjustments in place. Pedestal caps shall interlock with stringers to preclude tilting or rocking of the panels.

2.2.2 Underfloor Bracing

Special bracing to resist the effects of seismic or other forces shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and as shown on the approved detail drawings.

2.3 TESTS

Raised flooring shall be factory tested by an independent laboratory at the same position and maximum design elevation and in the same arrangement as shown on the drawings for installation so as to duplicate service conditions as much as possible.

2.3.1 Load Tests

Floor panel, stringer, and pedestal testing shall be conducted in accordance with CISCA Access Floors.

2.4 Test for Bond Strength of Factory Installed Floor Covering

The test panel shall be supported on pedestals and stringers as specified for the installed floor. The supports shall be braced as necessary to prevent sideways movement during the test. A test load of 4.45 kN shall be imposed on the test assembly through a hard plastic caster 75 mm in diameter and 25 mm wide. The caster shall be rolled completely across the center of the panel. The panel shall withstand 20 passes of the caster with no delamination or separation of the covering.

2.5 COLOR OF CARPET AND VCT/FLOORING

Color shall be in accordance with the Finish Schedule on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

The floor system shall be installed in accordance with the manufacturer's

instructions and with the approved detail drawings. Open ends of the floor, where the floor system does not abut wall or other construction, shall have positive anchorage and rigid support. Areas to receive raised flooring shall be maintained between 16 and 32 degrees C, and between 20 percent and 70 percent humidity for 24 hours prior to and during installation.

3.1.1 Preparation for Installation

The area in which the floor system is to be installed shall be cleared of all debris. Structural floor surfaces shall be thoroughly cleaned and all dust shall be removed. Floor coatings required for dust or vapor control shall be installed prior to installation of pedestals only if the pedestal adhesive will not damage the coating. If the coating and adhesive are not compatible, the coating shall be applied after the pedestals have been installed and the adhesive has cured.

3.1.2 Pedestals

Pedestals shall be accurately spaced, and shall be set plumb and in true alignment. Base plates shall be in full and firm contact with the structural floor, and shall be secured to the structural floor with steel expansion anchors.

3.1.3 Auxiliary Framing

Auxiliary framing or pedestals shall be provided around columns and other permanent construction and beneath panels that are substantially cut to accommodate utility systems. Special framing for additional lateral support shall be as shown on the approved detail drawings.

3.1.4 Panels

The panels shall be interlocked with supports in a manner that will preclude lateral movement. Perimeter panels, cutout panels, and panels adjoining columns must be fastened to the supporting components to form a rigid boundary for the interior panels. Floors shall be level within 2 mm measured with a 250 mm straight edge in all directions. Cut edges of composite panels shall be coated with a silicone rubber sealant or with an adhesive recommended by the panel manufacturer. Extruded vinyl edging shall be secured in place at all cut edges of all panel cut-outs to prevent abrasion of cables. Where the space below the floor is a plenum, cutouts for conduit and similar penetrations shall be closed using self-extinguishing sponge rubber.

3.1.5 Resilient Base

Base shall be provided at vertical wall intersections. Cracks and voids in walls and other vertical surfaces to receive base shall be filled with an approved filler. The base shall be applied after the floor system has been completely installed. Base shall be applied with adhesive in accordance with the manufacturer's recommendations.

3.1.6 Repair of Zinc Coating

Zinc coating that has been damaged, and cut edges of zinc-coated components and accessories, shall be repaired by the application of a galvanizing repair paint. Areas to be repaired shall be thoroughly cleaned prior to application of the paint.

3.2 TESTING OF ELECTRICAL RESISTANCE

Testing of electrical resistance in the completed installation shall be conducted in the presence of the Contracting Officer. Testing shall be in accordance with NFPA 99 modified by placing one electrode on the center of the panel surface and connecting the other electrode to the metal flooring support. Measurements shall be made at five or more locations. Each measurement shall be the average of five readings of 15 seconds duration at each location. During the tests, relative humidity shall be 45 to 55 percent and temperature shall be 21 to 24 degrees C. The panels used in the testing will be selected at random and will include two panels most distant from the ground connection. Electrical resistance shall be measured with instruments that are accurate within 2 percent and that have been calibrated within 60 days prior to the performance of the resistance tests. The metal-to-metal resistance from panel to supporting pedestal shall not exceed 10 ohms. The resistance between the wearing surface of the floor covering and the ground connection, as measured on the completed installation, shall be in accordance with paragraph FLOOR COVERING.

3.3 CLEANING AND PROTECTION

3.3.1 Cleaning

The space below the completed floor shall be free of all debris. Before any traffic or other work on the completed raised floor is started, the completed floor shall be cleaned in accordance with the floor covering manufacturer's instructions.

3.3.2 Protection

Traffic areas of raised floor systems shall be protected with a covering of building paper, fiberboard, or other suitable material to prevent damage to the surface. Cutouts shall be covered with material of sufficient strength to support the loads to be encountered. Plywood or similar material shall be placed on the floor to serve as runways for installation of heavy equipment. Protection shall be maintained until the raised floor system is accepted.

-- End of Section --

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SECTION 10430A

EXTERIOR SIGNAGE

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SECTION 10430A

EXTERIOR SIGNAGE

06/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (2000) Carbon Structural Steel

ASTM A 123/A 123M (2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 570/A 570M (1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 26/B 26M (1999) Aluminum-Alloy Sand Castings

ASTM B 62 (1993) Composition Bronze or Ounce Metal Castings

ASTM B 108 (1999) Aluminum-Alloy Permanent Mold Castings

ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2000) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C 1036	(1991; R 1997) Flat Glass
ASTM D 3841	(1997) Glass-Fiber-Reinforced Polyester Plastic Panels
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials

AMERICAN WELDING SOCIETY (AWS)

AWS C1.1M/C1.1	(2000) Recommended Practices for Resistance Welding
AWS D1.1	(2000) Structural Welding Code - Steel
AWS D1.2	(1997) Structural Welding Code - Aluminum

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 505	(1988) Metal Finishes Manual for Architectural and Metal Products
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
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SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3611	(1994; Rev D) Plastic Sheet, Polycarbonate General Purpose
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1.2 GENERAL

All exterior signage shall be provided by a single manufacturer. Exterior signage shall be of the design, detail, sizes, types, and message content shown on the drawings, shall conform to the requirements specified, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation.

1.3 CHARACTER PROPORTIONS AND HEIGHTS

Letters and numbers on indicated signs for handicapped-accessible buildings shall have a width-to-height ratio between 3:5 and 1:1 and stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X". Lower case characters are permitted.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G RE

Drawings showing elevations of each type of sign; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule showing the location, each sign type, and message shall be included.

SD-03 Product Data

Exterior Signage System; G RE

Manufacturer's descriptive data and catalog cuts.

Installation; G RE

Manufacturer's installation instructions and cleaning instructions.

SD-04 Samples

Exterior Signs

One sample of each type of sign. Each sample shall consist of a complete sign panel with letters and symbols. Samples may be installed in the work, provided each sample is identified and location recorded. Two samples of manufacturer's standard color chips for each material requiring color selection and 305 mm square sample of sign face color sample.

SD-10 Operation and Maintenance Data

Protection and Cleaning

Six copies of maintenance instructions listing routine maintenance procedures.

1.5 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of signage products.

1.6 DELIVERY AND STORAGE

Materials shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area in accordance with manufacturer's instructions.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

PART 2 PRODUCTS

2.1 EXTERIOR SIGNAGE SYSTEM

Exterior signage shall consist of a system of coordinated directional, identification, and regulatory type signs located where shown. Dimensions, details, materials, message content, and design of signage shall be as shown.

2.1.1 Panel And Post/Panel Type Signs

2.1.1.1 Posts

One-piece aluminum posts shall be provided with minimum 3.2 mm wall thickness. Posts shall be designed to accept panel framing system described. The post shall be designed to permit attachment of panel framing system with exposed fasteners. Caps shall be provided for each post.

2.1.1.2 Panels

Message panels shall be provided in sizes shown on drawings. Panels shall be fabricated of a minimum of 3.2 mm aluminum. Panels shall be cut from aluminum plate and have smooth edges and rounded corners as shown on the drawings.

2.1.1.3 Finishes

Post finish shall be two-component acrylic polyurethane. Metal panel system finish shall be two-component acrylic polyurethane.

2.1.1.4 Mounting

Permanent mounting shall be provided by embedding posts in concrete foundation.

2.2 GRAPHICS FOR EXTERIOR SIGNAGE SYSTEMS

2.2.1 Graphics

Signage graphics shall conform to the following:

Message shall be applied to panel using the silkscreen process. Silkscreened images shall be executed with photo screens prepared from original art. Handcut screens will not be accepted. Original art shall be defined as artwork that is a first generation pattern of the original specified art. Edges and corners shall be clean. Rounded corners, cut or ragged edges, edge buildup, bleeding or surfaces pinholes will not be accepted.

2.2.2 Messages

See drawings for message content. Typeface: Helvetica medium. Type size as indicated.

2.3 METAL PLAQUES

Design and location of plaques shall be as shown.

2.3.1 Cast Metal Plaques

2.3.1.1 Fabrication

Cast metal plaques shall have the logo, emblem and artwork cast in the bas relief technique. Plaques shall be fabricated from bronze.

2.3.1.2 Size

Plaque size shall be as shown.

2.3.1.3 Border

Border shall be flat band with bevel edge, unless noted otherwise.

2.3.1.4 Background

Background texture shall be fine pebble.

2.3.1.5 Mounting

Mounting shall be concealed.

2.3.1.6 Finish

Finishes shall consist of bronze with dark finish oxidized background. Letters shall be satin polished and entire plaque sprayed with two coats clear lacquer.

2.4 DIMENSIONAL BUILDING LETTERS

2.4.1 Fabrication

Letters shall be fabricated from cast bronze. Letters shall be cleaned by chemical etching or cleaned ultrasonically in a special degreasing bath. Letters shall be packaged for protection until installation.

2.4.2 Typeface

Typeface shall be helvetica medium, unless noted otherwise.

2.4.3 Size

Letter size shall be as indicated on the drawings.

2.4.4 Mounting

Threaded studs of number and size as recommended by manufacturer, shall be used for concealed anchorage. Letters which project from the building line shall have stud spacer sleeves. Letters, studs, and sleeves shall be of the same material. Templates for mounting shall be supplied. Letters shall project 25 mm from the face of masonry panel.

2.5 ALUMINUM ALLOY PRODUCTS

Aluminum alloy products shall conform to ASTM B 209M for sheet or plate, ASTM B 221M for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings.

Aluminum extrusions shall be provided at least 3 mm thick and aluminum plate or sheet at least 16 gauge thick. Welding for aluminum products shall conform to AWS C1.1M/C1.1.

2.6 ORGANIC COATING

Surfaces shall be cleaned, primed, and given a two-component acrylic polyurethane finish in accordance with NAAMM AMP 505 with total dry film thickness not less than 0.030 mm.

2.7 CAST BRONZE

Components shall be fabricated with sharp corners, flat faces, and accurate profiles. Burrs and rough spots shall be removed and polished. Faces shall be finished to a uniform high luster. Cast bronze shall be in accordance with ASTM B 62.

2.8 VINYL SHEETING FOR GRAPHICS

Vinyl sheeting shall be 5 to 7 year premium type and shall be in accordance with the flammability requirements of ASTM E 84 and shall be a minimum 0.08 mm film thickness. Film shall include a precoated pressure sensitive adhesive backing, Class 1, or positionable pressure sensitive adhesive backing, Class 3.

2.9 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall match in color and finish and shall be non-rusting,

non-corroding, and non-staining. Exposed fasteners shall be tamper-proof.

2.10 SHOP FABRICATION AND MANUFACTURE

2.10.1 Factory Workmanship

Work shall be assembled in the shop, as far as practical, ready for installation at the site. Work that cannot be shop assembled shall be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Welding shall be continuous along the entire area of contact. Exposed welds shall be ground smooth. Exposed surfaces of work shall have a smooth finish. Fastenings shall be concealed where practical. Joints exposed to the weather shall be formed to exclude water. Drainage and weep holes shall be included as required to prevent condensation buildup.

2.10.2 Dissimilar Materials

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of asphalt varnish or a coat of zinc-molybdate primer to prevent galvanic or corrosive action.

2.11 COLOR, FINISH, AND CONTRAST

Background color of products shall be Bone White to match curtain wall. For buildings required to be handicapped-accessible, the characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

PART 3 EXECUTION

3.1 INSTALLATION

Signs, plaques, and dimensional letters shall be installed in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs mounted on other surfaces shall not be installed until finishes on such surfaces have been completed.

3.1.1 Anchorage

Anchorage and fastener materials shall be in accordance with approved manufacturer's instructions for the indicated substrate. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Sign surfaces shall be cleaned in accordance with manufacturer's instructions. After signs are completed and inspected, the Contractor shall cover all project identification, directional, and other signs which may mislead the public. Covering shall be maintained until instructed to be removed by the Contracting Officer or until the facility is to be opened for business. Signs shall be cleaned, as required, at time of cover removal.

-- End of Section --

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SECTION 10440

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

- | | |
|-----------|---|
| AA DAF-45 | (1997) Designation System for Aluminum Finishes |
| AA PK-1 | (1999) Registration Record of Aluminum Association Alloy Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings and Ingot |

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- | | |
|----------|--|
| AAMA 605 | (1998) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels |
|----------|--|

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|------------|---|
| ANSI Z97.1 | (1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings |
|------------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|--|
| ASTM B 209 | (1996) Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM B 209M | (2000) Aluminum and Aluminum-Alloy Sheet and Plate (Metric) |
| ASTM B 221 | (2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes |
| ASTM B 221M | (2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) |

ASTM C 1036 (1991; R 1997) Flat Glass

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2 (1997) Structural Welding Code - Aluminum

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G RE

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location, each sign type, and message shall be included.

SD-03 Product Data

Installation; G RE

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Samples

Interior Signage

One sample of each of the following sign types showing typical quality and workmanship. The samples may be installed in the work, provided each sample is identified and location recorded.

- a. Directional sign.
- b. Door identification sign.

Two samples of manufacturer's standard color chips for each material requiring color selection.

SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions
Protection and Cleaning

Six copies of operating instructions outlining the step-by-step procedures required for system operation shall be provided. The instructions shall include simplified diagrams for the system as installed. Six copies of maintenance instructions listing routine procedures, repairs, and guides shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the facility, name of the Contractor, and contract number.

1.3 GENERAL

Interior signage shall be of the design, detail, sizes, types, and message content shown on the drawings, shall conform to the requirements specified, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation.

1.3.1 Character Proportions and Heights

Letters and numbers on indicated signs in handicapped-accessible buildings, which do not designate permanent rooms or spaces, shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X". Lower case characters are permitted. Suspended or projected overhead signs shall have a minimum character height of 75 mm .

1.3.2 Raised and Brailled Characters and Pictorial Symbol Signs (Pictograms)

Letters and numbers on indicated signs which designate permanent rooms and spaces in handicapped-accessible buildings shall be raised 0.8 mm upper case, Sans Serif or Simple Serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 16 mm in height, but no higher than 50 mm. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 152 mm minimum in height. Accessible facilities shall use the international symbol of accessibility.

1.4 QUALIFICATIONS

Signs, plaques, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original

packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

1.6 EXTRA STOCK

The Contractor shall provide three extra frames and extra stock of the following: Three blank plates of each color and size for sign types 3. Seven pressure-sensitive letters in each color and size for sign type. Three changeable message strips for sign type 3.

PART 2 PRODUCTS

2.1 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

Signs shall be fabricated of materials as specified herein.

2.1.1 Standard Room Signs

Signs shall consist of matte finish laminated thermosetting Type MP plastic. Units shall be frameless. Corners of signs shall be 20 mm radius.

2.1.2 Changeable Message Strip Signs

Changeable message strip signs shall consist of injection molded plastic captive message slider sign face with message slots and associated end caps, as detailed, for insertion of changeable message strips. Size of signs shall be as shown on the drawings. Individual message strips to permit removal, change, and reinsertion shall be provided as detailed. Corners of signs shall be 20 mm radius.

2.1.3 Type of Mounting For Signs

Extruded aluminum brackets, mounted as shown, shall be furnished for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs shall be by mechanical fasteners. Surface mounted signs shall be provided with countersunk mounting holes in plaques and mounting screws. Sign inserts shall be provided with 1.6 mm thick foam tape.

2.1.4 Graphics

Signage graphics for modular identification/directional signs shall conform to the following:

Fabricated aluminum letters 6 mm thick shall be provided and fastened to the message panel with concealed fasteners. Aluminum letter finish shall be as specified. Letters shall project 0.8 mm minimum from face of panel.

2.2 BUILDING DIRECTORIES

Building directories shall be lobby directories and shall be provided with a changeable directory listing consisting of the areas, offices and personnel located within the facility. Dimensions, details, and materials

of sign shall be as shown on the drawings. Where required, message content shall be as shown on drawings and schedule.

2.2.1 Header Panel

Header panel shall have background metal to match frame and shall have raised letters.

2.2.2 Doors

2.2.2.1 Door Glazing

Door glazing shall be in accordance with ASTM C 1036, Type 1, Class 1, Quality 3, minimum 3 mm thick clear polycarbonate sheet 4.8 mm thick.

2.2.2.2 Door Construction

Extruded aluminum door frame shall be of same finish as surrounding frame. Corners shall be mitered, reinforced, welded, and assembled with concealed fasteners. Hinges shall be standard with the manufacturer, in finish to match frames and trim. Glazing shall be set in frame with resilient glazing channels.

2.2.2.3 Door Locks

Door locks shall be manufacturer's standard, and shall be keyed alike.

2.2.3 Fabrication

Extruded aluminum frames and trim shall be assembled with corners welded and mitered to a hairline fit, with no exposed fasteners.

2.2.4 Changeable Letter/Message Strip Directory System

Directory shall consist of a non-illuminated unit with step or groove, laser or rotary engraved removable name strips. Design of unit shall be as shown in the drawings.

2.2.4.1 Construction

The directory shall be constructed of an aluminum 50 mm deep frame with satin clear anodized finish. Unit shall be surface mounted. Unit shall have a 75 mm high header with lettering as shown. Unit shall have a 10 mm face concealed hinge door and locking system with tempered safety glass. Door frame shall be aluminum with satin polished brass.

2.2.4.2 Message Strips

Namesrips shall be updatable by user with coupon book reordering and with 5 to 7 day delivery. Namesrips shall be acrylic sized per manufacturer's standard. Namesrips shall be felt grooved background with changeable upper and lower case Helvetica Medium letters. Tabbed vinyl letters and numbers shall be furnished in accordance with the schedule.

2.3 ALUMINUM ALLOY PRODUCTS

Aluminum extrusions shall be at least 3 mm thick, and aluminum plate or sheet shall be at least 1.3 mm thick. Extrusions shall conform to ASTM B 221M ; plate and sheet shall conform to ASTM B 209M . Where anodic coatings are specified, alloy shall conform to AA PK-1 alloy designation 514.0. Exposed anodized aluminum finishes shall be as shown. Welding for aluminum products shall conform to AWS D1.2.

2.4 ANODIC COATING

Anodized finish shall conform to AA DAF-45 as follows:

Clear (natural) designation AA-M10-C22-A31, Architectural Class II
0.010 mm or thicker.

2.5 FABRICATION AND MANUFACTURE

2.5.1 Factory Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.5.2 Dissimilar Materials

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

2.6 COLOR, FINISH, AND CONTRAST

Color shall be approved by Contracting Officer. To meet accessibility requirements, the characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Required blocking shall be installed as required. Signs which designate permanent rooms and spaces in handicapped-accessible buildings shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting location for such signage shall be so that a person may approach within 75 mm of signage without encountering protruding objects or standing within the swing of a door. Signs on doors or other surfaces shall not be installed until finishes on such surfaces

have been installed.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or shown shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood. Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 2 mm thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a 0.13 mm green flat stock treated with silicone. Foam pads shall be sized for the signage as per signage manufacturer's recommendations. Signs mounted to painted gypsum board surfaces shall be removable for painting maintenance. Signs mounted to lay-in ceiling grids shall be mounted with clip connections to ceiling tees.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

-- End of Section --

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-- End of Section Table of Contents --

SECTION 10445

ILLUMINATED SIGNAGE

04/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (2000) Carbon Structural Steel

ASTM A 123/A 123M (2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 500 (1999) Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 570/A 570M (1998) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 26/B 26M (1999) Aluminum-Alloy Sand Castings

ASTM B 62 (1993) Composition Bronze or Ounce Metal Castings

ASTM B 108	(1999) Aluminum-Alloy Permanent Mold Castings
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2000) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C 1036	(1991; R 1997) Flat Glass
ASTM C 1048	Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass
ASTM D 3841	(1997) Glass-Fiber-Reinforced Polyester Plastic Panels
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
AMERICAN WELDING SOCIETY (AWS)	
AWS C1.1M/C1.1	(2000) Recommended Practices for Resistance Welding
AWS D1.1	(2000) Structural Welding Code - Steel
AWS D1.2	(1997) Structural Welding Code - Aluminum
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM AMP 505	(1988) Metal Finishes Manual for Architectural and Metal Products
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(1999) National Electrical Code
SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)	
SAE AMS 3611	(1994; Rev D) Plastic Sheet, Polycarbonate General Purpose

1.2 SUMMARY

This Section includes custom illuminated signage for the Lobby consisting of glass motto artwork in metal frame, supporting structure, and back lighting. Signage shall be prefabricated in the factory and provided by a single manufacturer. Signage shall be of the design, detail, size, type, and message content shown on the drawings.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G A/E

Drawings showing plan, elevations, section details, typical members, and other components. Show anchors, reinforcement, accessories, layout, and installation details. Include wiring diagrams for internally illuminated signs.

SD-03 Product Data

Glass; G A/E

Metal Eggcrate Grilles; G A/E

Manufacturer's descriptive data and catalog cuts.

Installation; G A/E

Manufacturer's installation instructions and cleaning instructions.

Structural Support Requirements; G A/E

Design analysis and supporting calculations performed in support of specified signage.

SD-04 Samples

Aluminum Extrusions; G A/E

Sandblasted Glass, sample letter, and paint fill; G A/E

Metal Eggcrate Grilles; G A/E

One 300 mm length of framing for illuminated sign. One sample metal eggcrate 300 mm square. One glass sample 300 mm square including one actual size letter engraved in the glass, and paint

fill on the concealed face of the glass. Submit manufacturer's color chart for initial paint color selection.

SD-10 Operation and Maintenance Data

Protection and Cleaning

Submit maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The instructions shall include simplified diagrams for the equipment as installed.

1.4 QUALIFICATIONS

Manufacturer with at least 5 years experience in the design, fabrication, and installation of signs equal in scope, complexity, and design quality to the one depicted for this project.

1.5 DELIVERY AND STORAGE

Materials shall be wrapped in protective covering and crated for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area in accordance with manufacturer's instructions.

1.6 COORDINATION

Coordinate installation of anchorages for illuminated sign. Furnish setting drawings, templates, and directions for installing anchorages and other items that are to be built into supporting structure. Deliver such items to Project site in time for installation.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided, and the following:

Glass: 10 years.

Paint Fill: Free from fading and color change for the life of the sign.

PART 2 PRODUCTS

2.1 Materials

Aluminum Extrusions: ASTM B 221M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 6063-T5.

Aluminum Sheet and Plate: ASTM B 209M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 5005-H15.

Steel Tubing: Cold-formed steel tubing complying with ASTM A 500, Grade B.

Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent glass, flat), Quality q3 (glazing select). Provide products complying with ANSI Z97.1 and the requirements indicated below for class, thickness, and manufacturing process that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR, Part 1201 for Category II materials.

- a. Sandblasted Glass: Provide sandblasted, laminated glass from manufacturer's full range of textures and patterns for products of type indicated.
- b. Thickness: 10 mm or greater.
- c. Finish: Acid etch glass with hydrofluoric and hydrochloric acid, maintaining detail of sandblasted pattern. Finished glass product shall be white in appearance.

Metal Eggcrate Grilles: Satin anodized aluminum eggcrate grilles similar to model number EC300 by Architectural Grille, and as follows:

- a. 19 mm squares x 19 mm thick constructed of 3 mm thick flat extruded bars.

2.1.1.1 Panel Framing

Panel framing shall consist of aluminum tube members. Interior framing shall consist of aluminum angle framing welded to the panel frame system as designed. Framing members shall be designed to permit access to electrical equipment. Mounting shall be provided as shown. Framing members of steel shall be finished with semi-gloss baked enamel or two-component acrylic polyurethane.

2.1.1.1.1 Mounting

Mounting shall be provided by securing to masonry wall and metal framing with through-bolt connections as detailed.

2.2 ILLUMINATION

Concealed lighting shall be provided within panel framing members. Lighting shall be controlled by switch device as indicated. Top and bottom lighting shall be provided as indicated on the electrical drawings. Electrical equipment shall be UL or FM listed and comply with NFPA 70. Illumination shall be evenly distributed.

2.3 GRAPHICS

2.3.1 Graphics

Signage graphics shall conform to the following:

Letters shall be incised into the front side of the glass, and infilled with acrylic polyurethane paint similar to product by Mathews Paint Company.

2.4 ALUMINUM ALLOY PRODUCTS

Aluminum alloy products shall conform to ASTM B 209M for sheet or plate, ASTM B 221M for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings.

Aluminum extrusions shall be provided at least 3 mm thick and aluminum plate or sheet at least 16 gauge thick. Welding for aluminum products shall conform to AWS C1.1M/C1.1.

2.5 MECHANICAL FINISH

AA DAF-45A, A-M3x (Mechanical Finish: as specified); sand all exposed framing members in one direction only, parallel to length of member, with 120- and 320-grit abrasive. After installation, polish frames with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.

2.6 STEEL PRODUCTS

Structural steel products shall conform to ASTM A 36/A 36M. Sheet and strip steel products shall conform to ASTM A 570/A 570M. Welding for steel products shall conform to AWS D1.2.

2.7 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall match in color and finish and shall be non-rusting, non-corroding, and non-staining. Exposed fasteners shall be tamper-proof.

2.8 SHOP FABRICATION AND MANUFACTURE

2.8.1 Factory Workmanship

Work shall be assembled in the shop, as far as practical, ready for installation at the site. Work that cannot be shop assembled shall be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Welding to or on structural steel shall be in accordance with AWS D1.1. Welding shall be continuous along the entire area of contact. Exposed welds shall be ground smooth. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practical.

2.8.2 Dissimilar Materials

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of asphalt varnish or a coat of zinc-molybdate primer to prevent galvanic or corrosive action.

2.8.3 Shop Painting

Surfaces of miscellaneous metal work, except nonferrous metal, corrosion

resisting steel, and zinc-coated work, shall be given one coat of zinc-molybdate primer or an approved rust-resisting treatment and metallic primer in accordance with manufacturer's standard practice. Upon completion of work, damaged surfaces shall be recoated.

PART 3 EXECUTION

3.1 INSTALLATION

Illuminated sign shall be installed in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified.

3.1.1 Anchorage

Anchorage and fastener materials shall be in accordance with approved manufacturer's instructions for the indicated substrate. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with manufacturer's instructions. After signs are completed and inspected, the Contractor shall cover signs to protect from damage and accumulation of dirt and dust. Covering shall be maintained until instructed to be removed by the Contracting Officer or until the facility is to be opened for business. Signs shall be cleaned, as required, at time of cover removal.

3.2 FIELD PAINTED FINISH

Miscellaneous metals and frames shall be field painted in accordance with Section 09900 PAINTING. Anodized metals, masonry, and glass shall be protected from paint. Finish shall be free of scratches or other blemishes.

-- End of Section --

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SECTION 10505

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SECTION 10505

STEEL CLOTHING LOCKERS

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 366/A 366M	(1997) Commercial Quality (CS) Steel, Carbon, (0.15 Maximum Percent) Cold-Rolled
ASTM A 569/A 569M	(1998) Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial
ASTM A 653/A 653M	(1998) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 456	(1995) Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
ASTM D 2092	(1995) Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting

FEDERAL SPECIFICATIONS (FS)

FS AA-L-00486	(Rev. J) Lockers, Clothing, Steel
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MILITARY SPECIFICATIONS (MIL)

MIL-C-22750	(Rev. F) Coating, Epoxy, High Solids
MIL-P-23377	(Rev. G) Primer Coatings: Epoxy, Chemical and Solvent Resistant

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Types; G RE

Location; G RE

Installation

Numbering system

SD-03 Product Data

Material; G RE

Finish; G RE

Locker components

Assembly instructions

SD-04 Samples

Color chips

1.3 DELIVERY, HANDLING, AND STORAGE

Deliver lockers and associated materials in their original packages, containers, or bundles bearing the manufacturer's name and the name of the material. Protect from weather, soil, and damage during delivery, storage, and construction.

1.4 FIELD MEASUREMENTS

To ensure proper fits, make field measurements prior to the preparation of drawings and fabrication.

1.5 QUALITY ASSURANCE

1.5.1 Color Chips

Provide a minimum of three color chips, not less than 75 mm square, of each color for selection.

1.6 SYSTEM DESCRIPTION

1.6.1 Dust Covers

Dust covers shall be placed around the base and perimeters. The base shall be 100 mm high steel. End closers shall be installed. Maximum size of grouping is three units. Lockers will contain a single shelf at top with hanging rod and double prong wall hooks at each side. Louvers for air circulation shall be provided at both top and bottom. The model shall be "quick" type.

1.6.2 Locker Benches

Locker benches shall be stationary, with maple bench top, 240 mm wide x 32

mm thick, with rounded corners and edges. The wood shall be stained, sealed and varnished. The pedestals shall be fixed chrome steel and 444 mm high.

PART 2 PRODUCTS

2.1 TYPES

FS AA-L-00486. Provide Type II, double-tier, Style 1 lockers in the location, quantities and size indicated. Provide locker finish color as indicated. The body shall be formed and hanged and spot-welded. They shall be equipped with steel stiffener ribs.

2.2 MATERIAL

2.2.1 Steel Sheet

ASTM A 366/A 366M or ASTM A 569/A 569M, commercial quality, minimized spangle material. Prepare material surfaces for baked enamel finishing in accordance with FS AA-L-00486. The sheet steel is limited to the minimum following thicknesses:

1. Body/Shelf .6 mm
2. Door-outer face 1.5 mm
3. Door-inner face .9 mm
4. Door Frame 1.5 mm
5. Hinges 1.9 mm
6. Base .9 mm
7. Sloping Top .9 mm
8. Trim .9 mm

2.2.2 Chromium Coating

Nickel and chromium electrodeposited on the specified base metal. Conform to ASTM B 456, SC-3, as applicable to the base metal.

2.2.3 Finish

FS AA-L-00486.

Primer, MIL-P-23377; topcoat, MIL-C-22750. Clean, degrease and neutralize steel. Prime and finish with two coats of baked on enamel.

2.2.3.1 Color

As selected.

2.3 COMPONENTS

2.3.1 Built-In Locks

FS AA-L-00486. Provide a padlock eye in the door latching mechanism. Eyelet for padlock shall accept a 8 mm padlock shank, providing a secured locking 3 point latching system. The latch hook is to be constructed to

have a bevel on front upper edge to allow latch clip to ride up slope as latch closes.

Built-in locks are not required.

2.3.2 Coat Hooks

FS AA-L-00486, chromium plated.

2.3.3 Hanger Rods

FS AA-L-00486.

2.3.4 Door Handles

FS AA-L-00486. Provide zinc alloy or steel handles with a chromium coating.

2.3.5 Doors

FS AA-L-00486, see schedule.

2.3.5.1 Hinges

In addition to the requirements of FS AA-L-00486, provide 5-knuckle hinges, minimum 50 mm high. Fabricate knuckle hinges from not less than 2 mm thick steel sheet. A full height piano hinge may be provided if standard with the manufacturer. Weld or bolt hinges to the door frame. Weld, bolt, or rivet hinges to the door.

2.3.5.2 Latching Mechanisms

FS AA-L-00486.

2.3.6 Latch Strikes

FS AA-L-00486. Fabricate from not less than 2 mm thick steel sheet, except latch strike may be continuous from top to bottom and fabricated as part of the door framing.

2.3.7 Silencers

FS AA-L-00486.

2.3.8 Back and Side Panels, Tops, and Bottoms

FS AA-L-00486, see schedule.

2.3.9 Shelves

FS AA-L-00486. Fabricate from not less than 1.5 mm thick steel sheet.

2.3.10 Base Panels

FS AA-L-00486.

2.3.11 Legs

FS AA-L-00486. Provide lockers without legs, as indicated.

2.3.12 Number Plates

FS AA-L-00486. Aluminum. Provide consecutive numbers to be designated.

2.3.13 Fastening Devices

Provide bolts, nuts, and rivets as specified in FS AA-L-00486.

PART 3 EXECUTION

3.1 ASSEMBLY AND INSTALLATION

Assemble lockers according to the locker manufacturer's instructions. Align lockers horizontally and vertically. Secure lockers to wall and base with screws as indicated. Bolt adjacent lockers together. Adjust doors to operate freely without sticking or binding and to ensure they close tightly.

3.2 NUMBERING SYSTEM

Install number plates on lockers consecutively with odd numbers on top and even numbers on bottom.

]3.3 FIELD QUALITY CONTROL

3.3.1 Testing

Government may request performance-characteristic tests on assembled lockers in accordance with FS AA-L-00486. Lockers not conforming will be rejected.

3.3.2 Repairing

Remove and replace damaged and unacceptable portions of completed work with new units.

3.3.3 Cleaning

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner. Remove equipment, surplus materials, and rubbish from the site.

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SECTION 10522

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09/99

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 - 2.1.1 Dry Chemical Fire Extinguishers
- 2.2 FIRE EXTINGUISHER CABINETS

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SECTION 10522

FIRE EXTINGUISHERS AND CABINETS

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 (1991; R 1997) Flat Glass

FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)

FM P7825 (1999) Approval Guide

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (1998) Portable Fire Extinguishers

UNDERWRITERS LABORATORIES INC. (UL)

UL FPED (1999) Fire Protection Equipment Directory

UL 299 (1995; R 1998) Dry Chemical Fire Extinguishers

UL 711 (1995; R 1996) Fire Extinguishers

1.2 SYSTEM DESCRIPTION

Provide fire extinguishers and fire extinguisher cabinets in accordance with the required and advisory provisions of NFPA 10, and as specified herein. Fire extinguishers shall be UL FPED listed or FM P7825 approved. In the publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the SAS COE Fire Protection Engineer.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures." The fire protection engineer will review and approve all submittals in this section requiring Government approval.

*8

SD-03 Product Data

Fire extinguishers; ~~C A/E~~Fire extinguisher cabinets; ~~C A/E~~

Submit for each type of fire extinguisher.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original sealed containers or packages, bearing the manufacturer's name and brand designation. Handle and store materials to protect them from damage during the entire construction period. Replace all damaged items with new items.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

Fire Extinguishers shall be steel cylinder type with metal valve assembly, rechargeable, wall and cabinet mounted, and shall conform to the requirements specified herein. Provide mounting devices in accordance with the UL standards referenced herein. Fire test rating requirements are those established by UL 711.

2.1.1 Dry Chemical Fire Extinguishers

UL 299. Provide stored pressure multi-purpose dry chemical fire extinguishers, equipped with integral pressure indicating gage, 10 pound nominal charge weight having a minimum fire test rating of 2A:20B:C.

2.2 FIRE EXTINGUISHER CABINETS

Provide semi-recessed-mounted cabinets where cabinets are indicated. Cabinets shall be prime grade, cold-rolled, reannealed, process-leveled, furniture steel. Fabricate cabinet from 20 gage steel and door and trim from 18 gage steel. Provide fully welded joints ground smooth. On each jamb, provide at least two anchors or reinforcements spaced approximately 600 mm apart for building in or attaching the cabinets to adjacent construction. Doors shall be flush hollow metal type with fully welded joints ground smooth and full glazed opening. Provide door with continuous hinge, latch and pull. Hinge door for 180 degree opening. Glass shall conform to ASTM C 1036 and shall be clear, Type II (flat wired glass), Form 1 (wired, polished both sides), Quality q 8 (glazing quality), diamond or square wire mesh, 6 mm thick. Factory finish cabinet inside and out with one coat of enamel applied over a primer. Interior finish color shall be white. Exterior finish color shall be red.

PART 3 EXECUTION

3.1 INSTALLATION

Install mounting devices on walls and vertical surfaces for exposed wall mounted fire extinguishers. Install cabinets plumb and level. The top of installed extinguishers shall not be more than 5 feet above the finished floor. Provide fire extinguishers fully charged and ready for use.

-- End of Section --

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METAL CANOPIES

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SECTION 10530

METAL CANOPIES

09/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

- | | |
|-------|--|
| AA 45 | (1980) Aluminum Finishes |
| AA 46 | (1978) Anodized Architectural Aluminum |

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- | | |
|----------|--|
| AAMA 605 | (1992; Addenda Jan 1995) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels |
|----------|--|

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- | | |
|------------|---|
| AISC S303 | (1992) Steel Buildings and Bridges |
| AISC S335 | (1989) Structural Steel Buildings Allowable Stress Design and Plastic Design |
| AISC S342L | (1993) Load and Resistance Factor Design Specification for Structural Steel Buildings |

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|--------------|---|
| ANSI A10.3 | (1995) Power-Actuated Fastening Systems |
| ANSI B18.2.1 | (1996) Square and Hex Bolts and Screws Inch Series |
| ANSI B18.6.2 | (1972; R 1993) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws |
| ANSI B18.6.3 | (1972; R 1997) Machine Screws and Machine Screw Nuts |

ASME INTERNATIONAL (ASME)

ASME/ANSI B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)
ASME/ANSI B18.21.1	(1994) Lock Washers (Inch Series)
ASME/ANSI B18.21.2M	(1994) Lock Washers (Metric)
ASME/ANSI B18.22M	(1981; R 1990) Metric Plain Washers
ASME/ANSI B18.22.1	(1965; R 1998) Plain Washers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1996) Carbon Structural Steel
ASTM A 47M	(1990; R 1996) Ferritic Malleable Iron Castings (Metric)
ASTM A 47	(1990; R 1995) Ferritic Malleable Iron Castings
ASTM A 48M	(1994; Rev. A) Gray Iron Castings (Metric)
ASTM A 48	(1994; Rev. A) Gray Iron Castings
ASTM A 53	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 123/A 123M	(1997; Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 500	(1996) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 569/A 569M	(1997) Commercial Steel (CS) Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled
ASTM A 653/A 653M	(1997) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 687	(1993) High-Strength Nonheaded Steel Bolts and Studs

ASTM A 780	(1993; Rev. A) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 786/A 786M	(1993) Rolled Steel Floor Plates
ASTM B 26/B 26M	(1997) Aluminum-Alloy Sand Castings
ASTM B 108	(1997) Aluminum-Alloy Permanent Mold Castings
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 429	(1995) Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 1187	(1997) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E 488	(1996) Strength of Anchors in Concrete and Masonry Elements

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1998) Structural Welding Code - Steel
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U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-664	(Rev. D) Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant
FS RR-G-1602	(Rev. D) Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM BG	(1993) Metal Bar Grating Manual
NAAMM PR	(1995) Pipe Railing Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (1997) Life Safety Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1995) Power Tool Cleaning

SSPC SP 6 (1994) Commercial Blast Cleaning

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Metal Canopies; G A/E

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

Include shop drawings for structural framing system, roofing panels, and other system components and accessories that are not fully detailed or dimensioned in manufacturer's product data. Show direction of water flow. Furnish complete erection drawings prepared by or under the supervision of a professional engineer legally authorized to practice in the jurisdiction where the Project is located. Include details showing fabrication and assembly of the metal canopy systems. Show anchorage, elevations, sections and details with dimensions, sizes, thicknesses, gauges, configurations, finishes, and flashings. Provide layouts of panels on roofs, details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Include transverse cross-sections.

SD-03 Product Data

Metal Canopies; G A/E

Product data consisting of manufacturer's product information for components and accessories.

SD-04 Samples

Exposed aluminum

Samples for verification purposes of roofing and trims. Provide sample panels 300 mm long by actual panel width, in the profile, style, color, and texture indicated. Include clips, battens, fasteners, closures, and other panel accessories.

1.3 QUALITY ASSURANCE

1.3.1 Installer Qualifications

Engage an experienced Installer to erect the pre-engineered metal canopies who has specialized in the erection and installation of types of systems similar to that required for this project and who is certified in writing by the metal canopy manufacturer as qualified for erection of the manufacturer's products.

1.3.2 Manufacturer's Qualifications

Provide pre-engineered canopy manufactured by a firm experienced in manufacturing metal canopy systems that are similar to those indicated for this project and have a record of successful in-service performance. Obtain the metal canopy system components, including structural framing, roof covering, and accessory components, from one source from a single manufacturer.

1.3.3 Design Criteria

The drawings indicate sizes, profiles, and dimensional requirements of the pre-engineered canopy system. Canopy systems having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept or intended performance. The burden of proof for equality is on the proposer.

1.4 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1. Use procedures, materials, and equipment of the type required for the work.

1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

1.6 WARRANTY

The Contractor and the metal canopy manufacturer shall warrant the entire installation against defects in labor and materials for a period of one (1) year commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Subject to compliance with requirements, provide products by one of the following:

- A. Dittmer Architectural Aluminum
- B. E.L. Burns Company, Inc.

- C. Mapes Industries, Inc.
- D. Superior Metal Products Company

2.2 MATERIALS

2.2.1 Structural Carbon Steel

ASTM A 36/A 36M.

2.2.2 Structural Tubing

ASTM A 500.

2.2.3 Steel Pipe

ASTM A 53, Type E or S, Grade B.

2.2.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A 47M.

2.2.5 Anchor Bolts

ASTM A 307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.2.5.1 Expansion Anchors and Sleeve Anchors

Provide 10 mm to 13 mm diameter as necessary for structural requirements, expansion anchors or sleeve anchors. Minimum concrete or masonry embedment shall be as detailed on the drawings.

2.2.5.2 Bolts, Nuts, Studs and Rivets

ASME/ANSI B18.2.2 and ASTM A 687 or ASTM A 307.

2.2.6 Aluminum Alloy Products

Conform to ASTM B 209M for sheet plate, ASTM B 221M for extrusions and ASTM B 26/B 26M or ASTM B 108 for castings, as applicable. Provide aluminum extrusions at least 3 mm thick and aluminum plate or sheet at least 1.3 mm thick.

2.3 CANOPY FABRICATION

Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged, and reassembled with a minimum amount of labor. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

2.3.1 Structural Framing

Shop-fabricate framing components to indicated size and section with connector plates and other plates required for erection, welded in place. Provide holes for anchoring or connections shop-drilled or punched to template dimensions.

Shop Connections: Provide power riveted, bolted, or welded shop connections.

Field Connections: Provide bolted field connections.

Roof Panels: Roll formed aluminum sheet with interlocking seams.

Beams, and Fascias: Extruded aluminum sections of sizes and shapes indicated.

Notched and fabricated for mechanical connection.

Provided cut-outs and internal deflectors in members as indicated to act as internal water drainage system.

Provide aluminum downspouts and other drainage items for a complete installation.

2.4 FABRICATION FINISHES

2.4.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A 123/A 123M, ASTM A 153/A 153M or ASTM A 653/A 653M, Z275, as applicable.

2.4.2 Galvanize

Anchor bolts, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.4.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780 or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.4.4 Shop Cleaning and Painting

2.4.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

2.4.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions.

2.4.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.4.6 Aluminum Surfaces

2.4.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

High-Performance Organic Coatings: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

Fluorocarbon 2-Coat Coating System: Manufacturer's standard 2-coat thermocured system, complying with AAMA 605, composed of specially formulated inhibitive primer, fluorocarbon color coat, and clear fluorocarbon topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.

Color and Gloss:: To match color and sheen designations as specified under Section 08900 "Glazed Curtain Wall."

2.4.6.2 Unexposed Sheet, Plate, and Extrusions

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA 45, or AA 46.

PART 3 EXECUTION

3.1 INSTALLATION

Install prefabricated canopy systems at locations indicated, according to manufacturer's instructions. Items listed below require additional procedures.

3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening prefabricated canopies securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible

materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.3 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.5 FINISHES

3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to FS TT-P-664 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D 1187, asphalt-base emulsion.

3.5.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.5.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than -15 degrees C above the dew point of the surrounding air, or when surface temperature is below 7 degrees C or over 35 degrees C, unless approved by the Contracting Officer.

3.6 Cleaning and Touch up

Clean component surfaces of matter that could preclude paint bond. Touch up abrasions, marks, skips, or other finished surfaces.

-- End of Section --

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SECTION 10550

POSTAL SPECIALTIES

07/01

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 - 2.2.3 Compartment Doors and Trim

PART 3 EXECUTION

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- 3.2 PREPARATION
- 3.3 INSTALLATION

-- End of Section Table of Contents --

SECTION 10550

POSTAL SPECIALTIES

07/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	Aluminum-Alloy Extruded Bar, Rod, Wire Shape and Tub

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Horizontal Mailboxes; G RE

For each type of postal specialty specified show details of fabrication and installation. Include plans, elevations, sections and attachments to other work.

SD-03 Product Data

Horizontal Mailboxes; G RE

For each type of postal specialty specified include details of construction relative to materials, dimensions of individual components, profiles and finishes.

SD-04 Samples

Color charts

Initial Selection: Manufacturer's color charts showing the full range of colors and finishes of exposed materials and accessories available for each type of postal specialty indicated.

Verification: Full-size units of each type of exposed color and

finish required for each type of postal specialty specified. Where finishes involve normal color and texture variations, include sample set showing the full range of variations expected.

PART 2 PRODUCTS

2.1 MATERIALS

Aluminum alloy and temper test suited for the intended use and finish indicated. Plate and Sheet in accordance with ASTM B 209, anodized finish where not exposed. Extruded Bars and Shapes in accordance with ASTM B 221.

2.2 HORIZONTAL MAILBOXES

2.2.1 General

Rear-Loading, Horizontal Mailboxes consisting of multiple compartments enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from rear of unit with accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.

2.2.2 Mail Compartments and Wall Receptacles

Fabricate concealed components of units from manufacturer's standard aluminum. Equip each compartment to receive tenant's name card.

2.2.3 Compartment Doors and Trim

Fabricate doors and trim from extruded aluminum to suit type of installation and loading method. For identification use plastic tabs with heat-stamped numbers on each door. For sorting, provide slots and clear plastic openings to receive tenant's name cards.

PART 3 EXECUTION

3.1 EXAMINATION

Examine mailroom areas and conditions for compliance with clearances and roughing-in requirements affecting installation of postal specialties. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

In addition to requirements of these Specifications, comply with manufacturer's written instructions and recommendations for preparing substrates, installing anchors, and applying postal specialty units.

3.3 INSTALLATION

Install postal specialties level and plumb, according to manufacturer's written instructions, roughing-in drawings, original design and referenced standards.

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SECTION 10652

OPERABLE PANEL PARTITIONS

09/99

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SECTION 10652

OPERABLE PANEL PARTITIONS

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423	(1990; Rev. A) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(1997; Rev. A) Surface Burning Characteristics of Building Materials
ASTM E 90	(1997) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E 152	(1981; Rev. A) Fire Tests of Door Assemblies
ASTM E 336	(1997) Measurement of Airborne Sound Insulation in Buildings
ASTM E 557	(1993) Architectural Application and Installation of Operable Partitions

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252	(1995) Fire Tests of Door Assemblies
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UNDERWRITERS LABORATORIES INC. (UL)

UL 10B	(1997) Fire Tests of Door Assemblies
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1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Partition layouts

Submit drawings for the system that include dimensions and weight of stacked partition, layout of the work, track and jamb fastening methods, seal details, and installation details. Submit wiring diagram and installation details for electrical operator.

SD-03 Product Data

Suspension system

Covering

Accessories

SD-04 Samples

Covering

SD-06 Test Reports

Laboratory acoustical requirements

Acoustical test

SD-07 Certificates

Panel weight

Warranty

SD-10 Operation and Maintenance Data

Operable panel partitions, Data Package 1

Submit data package in accordance with Section 01700, "Operation and Maintenance Data."

1.3 DELIVERY, HANDLING AND STORAGE

Deliver materials to project site in the manufacturer's original, unopened, and undamaged packages with labels legible and intact. Provide labels to indicate the manufacturer, brand name, size, finish, and placement location. Store folding partitions and accessories in unopened packages in a manner that will prevent damage. Handle partition materials in accordance with manufacturer's instructions.

1.4 WARRANTY

Partitions shall be warranted against defects in material and workmanship for a period of two years from date of installation.

PART 2 PRODUCTS

2.1 OPERABLE PANEL PARTITIONS

Provide panel partitions, factory finished, supported from overhead track without floor guides, and complete with hardware, track, and accessories necessary for operation. Provide concealed framework with a covering of vinyl fabric. Provide partitions omni-directional type as indicated. Provide finishes and colors approved by the Contracting Officer. Provide chalkboards/markerboards and tackboards as indicated. Provide operable panel wall with a Sound Transmission Class (STC) range of 50, Noise Reduction Coefficient (NRC) .75.

2.2 MATERIALS

2.2.1 Fabric Covering

Vinyl, ASTM E 84, flame spread rating 25 or less, fuel contribution rating of 15 or less, smoke generation of 50 or less. Perforated steel, 0.65-0.75 in accordance with ASTM C 423.

2.2.2 Seals and Sweepstrips

Provide perimeter seals of manufacturer's standard product, without crack or craze when subjected to severe usage. Provide mechanical bottom seal that can be raised or lowered for positive control. Provide manufacturer's vertical seals between panels to ensure acoustical rating.

2.2.3 Ceiling Guards

Furnish partitions with ceiling guards or integral track and ceiling guards as recommended by the manufacturer.

2.2.4 Chalkboards/Markerboards

Provide chalkboards/markerboards with aluminum or steel frame with writing surface of porcelain steel that do not protrude 3 mm beyond panel face. Color shall be white.

2.2.5 Tackboard

Provide tackboard with steel or aluminum frame. Minimum 6 mm thick, tacking surface covered with self-sealing decorative vinyl. Tacking surfaces laminated to rigid backing substrate.

2.3 PERFORMANCE REQUIREMENTS

2.3.1 Fire Endurance

For partitions more than 5.6 square meters in area, provide fabric and lining with flame spread rating of 25 or less, fuel contribution rating of 15 or less, smoke generation of 50 or less when tested in accordance with ASTM E 84.

2.3.2 Laboratory Acoustical Requirements

Test folding partitions in accordance with ASTM E 90 by a laboratory

accredited by the National Institute of Standards and Technology. Partitions shall attain a sound transmission class (STC) of not less than 50 in a fully extended position. Partition tested shall be of the same construction, materials, and model number as the partition to be provided and shall be fully operable. Test specimen shall be not less than 12 square meters in area.

2.4 FABRICATION

2.4.1 Panel Construction

Provide panels of tackable base, laminated to appropriate structural acoustical backing, mounted in full perimeter protective frame of steel or steel reinforced aluminum. Frame shall enclose and protect all edges of the surface material. Provide panel finish of vinyl fabric. Provide single panels. Provide porcelain enamel chalkboard/markerboard where indicated. Panel weight shall be a minimum of 26 kg per square meter for STC up to 40, 36 kg per square meter for STC up to 45, and 41 kg per square meter for STC up to 50, 48 kg square meter for STC up to 53.

2.4.2 Suspension System

Provide a suspension system consisting of steel or heavy duty extruded aluminum track connected to the structural support by threaded rods, and trolleys designed to support the weight of the partition. Provide steel track of 5 mm minimum, phosphate treated or painted. Tracks may have an integral ceiling guard. Provide 2 trolleys per panel with 2 ball bearing polymer or steel tired wheels.

2.4.3 Hardware

Provide heavy-duty type hardware standard with the manufacturer. Provide pulls and latches for all partitions. Provide partitions with privacy latches and foot bolts.

2.4.4 Accessories

Provide porcelain steel chalkboards/markerboards single pass door recessed illuminated exit sign as standard equipment from the manufacturer of the panels.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Work Prepared for Partition

Check openings scheduled to receive operable partitions for correct dimensions. Install partitions in accordance with the approved partition layouts, manufacturer's directions, and ASTM E 557. Structural support for the track support elements shall be as indicated.

3.2 FIELD TESTS

3.2.1 Visual Test

Conduct visual field tests for light leakage with all room lights turned on in the space on one side of the partition. Darken space on the other side of the partition. There shall be no light leakage from the lighted space to the darkened space. If light leakage does occur, adjust the partition to correct the problem and retest.

3.3 CLEANING

Clean any soiled parts of the partition in accordance with manufacturer's printed instructions.

-- End of Section --

SECTION 10672

MOBILE STORAGE SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

- A. American National Standards Institute (ANSI) Standards:
 - 1. Applicable standards for fasteners used for assembly.
- B. American Society for Testing and Materials (ASTM) Standards:
 - 1. Applicable standards for steel materials used for fabrication.
- C. American Institute Of Steel Construction (AISC) Standards:
 - 1. Applicable standards for steel materials used for fabrication.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Mechanically assisted, carriage mounted high-density mobile storage units, post-and-beam metal storage shelving, support rails, fabrication, and installation including leveling of support rails.
- B. Related Sections include the following:
 - 1. Division 12 casework sections for cantilever-bracket shelving supported by wall-mounted standards.

1.3 SYSTEM DESCRIPTION

- A. General: System consisting of manufactured storage units mounted on track-guided carriages to form a compact storage system. System design to permit access to any single aisle by manually moving units until the desired aisle is opened. The carriage/rail system to provide uniform carriage movement along the total length of travel.
- B. Carriage System Design and Features: Carriage system consisting of a formed structural steel frame with hardened steel wheel riding on steel rails surface mounted to the floor. Rails types selected by the manufacturer to ensure smooth operation and self-centering of mobile storage units during travel without endplay or binding. Rail types, quantities and spacing to be selected by the manufacturer to suit installation conditions and requirements. All bearings used in the drive mechanism to be permanently shielded and lubricated.

- C. Movement Controls: Triple or single arm operating wheels with rotating hand knobs. Provide on the accessible drive ends of shelf units, centered on the end panel, located 991 mm from the base of each unit to permit units to be moved, and create a single aisle opening.
- D. Drive System: System designed with a positive type mechanically assisted drive which minimizes endplay, ensures there is no play in the drive handle, and that carriages will stop without drifting.
 - 1. Include a chain sprocket drive system for each movable carriage to ensure that carriages move uniformly along the total length of travel, even with unbalanced loads. All system components selected to ensure a smooth, even movement along the entire carriage length. Drive system gearing designed to permit .4536 kg of force applied to the drive handle to move a minimum of 1815 kg of load.
 - 2. Tensioning device provided on each chain drive with provision for adjusting tension without removing end panels.
 - 3. All bearings used in the drive mechanism to be permanently shielded and lubricated.
- E. Safety Features:
 - 1. Color-coded visual indicators to provide verification that carriages are in a locked or unlocked mode.
 - 2. A single safety lock button, mounted on each operating wheel hub, to permit moving a carriage in either direction to create a new access aisle when pulled out (unlocked), or locking the carriage when pushed in.
- F. Finishes:
 - 1. Fabricated Metal Components And Assemblies: Manufacturer's standard powder coat paint finish.
 - 2. End Panels, Accessible Ends: Plastic laminate, manufacturer's standard textures and patterns.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance for Post-and-Shelf Metal Storage Shelving: Provide metal storage shelving capable of withstanding the loads indicated when tested according to MH 28.1, "Specification for the Design, Testing, Utilization and Application of Industrial Grade Steel Shelving."
- B. Seismic Performance: Provide metal storage shelving capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.5 SUBMITTALS

*8

- A. SD-02 Shop Drawings ~~G, A/E~~: Show fabrication, assembly, and installation details including descriptions of procedures and diagrams. Show complete extent of installation layout including clearances, spacings, and relation to adjacent construction in plan, elevation, and sections. Indicate clear exit and access aisle widths; access to concealed components; assemblies, connections, attachments, reinforcement, and anchorage; and deck details, edge conditions, and extent of finish flooring within area where units are to be installed.
1. Show installation details at non-standard conditions. Furnish floor layouts, technical and installation manuals for every unit shipment with necessary dimensions for rail layout and system configuration at the project site. Include installed weight, load criteria, furnished specialties, and accessories.
 2. Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and erection procedures. Specifically include the following:
 - a. Location, position and configuration of tracks on floor.
 - b. Plan layouts of positions of carriages, including all required clearances.
 - c. Details of shelving, indicating method and configuration of installation in carriages.
 3. Provide location and details of anchorage devices to be embedded in or fastened to other construction.
 4. Provide installation schedule and complete erection procedures to ensure proper installation.
- B. SD-03 Product Data ~~G, A/E~~: Submit manufacturer's product literature and installation instructions for each type of shelving, track and installation accessory required. Include data substantiating that products to be furnished comply with requirements of the contract documents. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage shelving.
- C. SD-04 Samples for Initial Selection ~~G, A/E~~: For units with factory-applied color finishes. Include similar Samples of accessories involving color selection.
- D. Samples for Verification ~~G, A/E~~: For the following components, of size indicated below.
1. Posts: 305 mm long.
 2. Shelves: Full size, but not more than 610 mm wide by 305 mm deep.
 3. Shelf-to-Post Connectors: Full size.
 4. Shelf Labels: Full size.
- E. Qualification Data: For Installer. Furnish signed certification by manufacturer attesting that installers comply with specified requirements. Submit manufacturer's certification that products comply with requirements of the contract documents.

- F. SD-10 Operation and Maintenance Data: Provide in form suitable for inclusion in maintenance manuals for mobile storage units. Data shall include operating and maintenance instructions, parts inventory listing, purchase source listing, emergency instructions, and related information.

1. Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against using materials and methods, which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain metal storage shelving through one source from a single manufacturer.

1.7 WARRANTY

- A. Provide a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the established warranty period.
 1. Warranty Period: Five years from date of acceptance by Owner.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions before fabrication. Indicate verified measurements on Shop Drawings. Coordinate fabrication and delivery to ensure no delay in progress of the Work.
- B. Environmental Limitations: Do not deliver or install metal storage shelving until spaces are enclosed and weatherproof, wet work in spaces is completed and dry, and ambient temperature is being maintained at the levels indicated for Project when occupied for its intended use.

1.10 COORDINATION

- A. Coordinate storage shelving system installation with other work to minimize possibility of damage and soiling during remainder of construction period.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- C. Steel Tubing: ASTM A 513, Type 2.
- D. Post installed Expansion Anchors in Concrete: With capability to sustain, without failure, a load equal to 4 times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition (mild).
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching foot plates for shelving units, and with capability to sustain, without failure, a load equal to 10 times that imposed by shelving systems, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- F. Grout: Provide non-shrink, non-staining hydraulic cement compound.

2.2 MANUFACTURED COMPONENTS

- A. Rails:
 - 1. Material: ASTM/AISI Type 1035 or 1045 steel, manufacturer's selection.
 - 2. Capacity: 1385kg/M of carriage.
 - 3. Minimum Contact Surface: 16 mm wide.
 - 4. Provide rail sections in minimum 1830 mm lengths.
 - 5. Rail configuration shall permit attachment to top of structural floor system with provision for leveling rails to compensate for variations in floor surface level.
 - 6. Provide rail connections designed to provide horizontal and vertical continuity between rail sections, to gradually transfer the concentrated wheel point load to and from adjoining rail sections. Butt joints are not permitted.

- B. Floor/Ramp Sheathing: Minimum 19 mm, 5-ply underlayment grade plywood. Particleboard sheathing materials are not permitted.
- C. Carriages:
 - 1. Manufacturer's movable carriages fabricated of welded or bolted steel construction. Galvanized structural components and/or riveted carriages are unacceptable.
 - a. Size: 750 mm wide x 1800 mm long x 2250 mm high.
 - 2. Provide fixed carriages of same construction and height as the movable carriages, anchored to rails. Setting fixed shelving directly on floors is not permitted.
 - 3. When required, provide bolted carriage splices designed to maintain proper unit alignment and weight load distribution.
 - 4. Design carriages to allow the shelving uprights to recess and interlock into the carriages a minimum of 19 mm. Top mount carriages are unacceptable.
 - 5. Provide each carriage with two wheels per rail.
- D. Drive/Guide System:
 - 1. Drive system that prevents carriage whipping, binding and excessive wheel/rail wear under normal operation.
 - a. If line shafts are used, all wheels on one side of carriage shall drive.
 - b. If synchronized drives are used, a minimum of one wheel assembly driving both sides of carriage at center location required. Drive shaft shall exhibit no play or looseness over the entire length of that assembly.
 - 2. Shafts: Solid steel rod or tube.
 - 3. Shaft Connections: Secured couplings.
 - 4. Bearing Surfaces: Provide rotating load bearing members with ball or roller bearings. Provide shafts with pillow block or flanged self-aligning type bearings.
- E. Wheels:
 - 1. Materials: Type 1045 solid steel. Minimum load capacity per wheel: 1455 kg.
 - 2. Size: Minimum 127 mm, outside diameter drive wheels.
 - 3. Guides: Determined by manufacturer; minimum 2 locations.
- F. Face Panels:
 - 1. Materials: Plastic laminate clad particle board with plastic edging on vertical edges.
 - 2. Finishes: Selected from manufacturer's standard available colors and patterns.

2.3 POST-AND-SHELF METAL STORAGE SHELVING

- A. Design: Wedge-lock type consisting of uprights, shelves, and shelf supports, designed to be assembled without fasteners or clips. Shelves shall not have any holes on exposed surfaces. Front and back flanges shall be flush with outside faces of posts. Design shall permit individual shelf adjustment and/or removal anywhere along the entire height of uprights.
- B. Materials and Workmanship: Fabricate units from Class 1, cold-rolled steel sheet with all bends sharp and true and no exposed "knife" edges.
- C. Uprights: Formed from steel sheet to a hollow "tee" shape for intermediate supports and formed angles for end supports. Uprights shall have keyhole slots on inner wall only. Provide with sheet steel panels full height and depth of end uprights. Provide intermediate "tee" uprights between adjacent units.
- D. Shelves: Form from sheet steel with flanges on all sides and return hem on front and back flanges. Ends shall be formed to clear inside of upright offset panels. Shelves shall be independently adjustable. Provide all shelves with slots for file dividers.
- E. Canopy Tops: Same construction as shelf units.
- F. Shelf Supports: Form from heavy gauge steel sheet with four solid steel shoulder rivets, two per ear, that interlock with inner wall of uprights.
- G. Nominal Shelf Dimensions:
 - 1. Standard Width: 915 mm, with 762 mm sections used to meet project requirements.
 - 2. Shelf Edge Vertical Profile: 19 mm maximum.
 - 3. Vertical Adjustment Increment: 38 mm.
 - 4. Width Of Intermediate Uprights: 51 mm.
 - 5. Clearance Between Uprights: Nominal shelf section width minus 51 mm.
 - 6. Levelness Of Completed Shelf Units: 3.2 mm between bottom shelf and canopy top, measured along the edge of any upright in any direction.
 - 7. Number of Vertical Shelf Spaces: 8.
 - 8. Vertical Shelf-To-Shelf Spacing: 245 mm.
- H. Load Carrying Capabilities: Provide shelf units capable of supporting 18kg/305 mm with maximum deflection of L/140. Shelves shall exhibit no permanent deflection under fully loaded conditions.
- I. Accessories: Provide 4 file dividers per shelf.

2.4 FABRICATION

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Wheels: Provide precision ground, balanced and hardened units with permanently shielded and lubricated bearings.
- C. Carriages: Fabricate to ensure no more than 6 mm maximum deviation from a true straight line. Splice and weld to ensure no permanent set or slippage in any spliced or welded joint when exposed to forces encountered in normal operating circumstances.
- D. Fabricate metal storage shelving square and rigid with posts plumb and true, and shelves flat and free of dents or distortion. Fabricate connections to form a rigid structure, free of buckling and warping.
- E. Form backs of shelving units up to 1219 mm wide from 1 piece.
- F. Shear and punch metals cleanly and accurately. Remove burrs.
- G. Form edges and corners free of sharp edges or rough areas. Fold back and crimp exposed edges of unsupported sheet metal to form a 13-mm-wide hem on the concealed side; ease edges of metal plate to radius of approximately 1.0 mm.
- H. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- I. Weld corners and seams continuously to comply with referenced AWS standard and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - 5. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- J. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
- K. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.
- L. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- M. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish all steel surfaces, components, and accessories except prefinished stainless steel and chrome-plated surfaces.

2.6 GALVANIZED STEEL FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.7 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
- B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 0.05 mm.
 - 1. Color and Gloss: As selected from manufacturer's full range.
- C. Laminate Finish: Provide factory applied laminate panels at locations indicated on approved shop drawings.
- D. Edgings: Provide preformed edging, color-matched to unit colors selected.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of mobile storage units.
- B. Verify that building structural system is adequate for installing mobile storage units at locations indicated on approved shop drawings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Rails:

1. Lay out rails using full-length units to the maximum extent possible. Use cut lengths only at ends to attain total length required. Locate and position properly, following dimensions indicated on approved shop drawings. Verify thickness of finished floor materials to be installed (by others) and install level 1.6 mm above finished floor surfaces.
2. Verify level, allowing for a minimum 6 mm of grout under high points. Position and support rails so that no movement occurs during grouting.
3. Set rails in full grout bed, completely filling voids entire length of all rails including rail connectors. Trim up sides flush with rails to ensure proper load transfer from rail to supporting floor. Using shims in lieu of full grouting is not permitted.
4. Installation Tolerances: Do not exceed levelness of installed rails listed below:
 - a. Maximum Variation From True Level Within Any Module: 2.4 mm.
 - b. Maximum Variation Between Adjacent (Parallel) Rails: 1.6 mm, perpendicular to rail direction.
 - c. Maximum Variation In Height: 0.8 mm, measured along any 3.05 M rail length.
5. Verify rail position and level; anchor to structural floor system with anchor type and spacings indicated on approved shop drawings.

B. Floors/Ramps:

1. General: Finished elevation shall be 1.6 mm below top of rails.
2. Place floors and ramps to the extent indicated on approved shop drawings. Extend ramps under all movable ranges. Provide ramp at both ends of mobile system. Do not extend ramps beyond the ends of carriages.
3. Construct floors and ramps to prevent warping or deformation of floor panels in a normal operating environment. Support panels on levelers at maximum 400 mm on center.
4. Ramp Slope: Do not exceed the following:
 - a. ADA Accessible Ramps: Maximum 1:12 slope (4.76 degrees).

C. Shelving Units Installation:

1. General: Follow layout and details shown on approved shop drawings and manufacturer's printed installation instructions. Position units level, plumb; at proper location relative to adjoining units and related work.
2. Carriages:
 - a. Place movable carriages on rails. Ensure that all wheels track properly and centering wheels are properly seated on

centering rails. Fasten multiple carriage units together to form single movable base where required.

- b. Position fixed carriage units to align with movable units.

3. Shelving Units:

- a. Permanently fasten shelving units to fixed and movable carriages with vibration-proof fasteners.
- b. Stabilize shelving units following manufacturer's written instructions. Reinforce shelving units to withstand the stress of movement where required and specified.

3.3 FIELD QUALITY CONTROL

- A. Verify shelving unit alignment and plumb after installation. Correct if required following manufacturer's instructions.
- B. Remove components which are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 ADJUSTING AND CLEANING

- A. Adjust components and accessories to provide smooth operating, visually acceptable installation.
- B. Verify that shelves and shelf-to-post connectors adjust easily and properly.
- C. On completion of installation, clean exposed surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace mobile storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by mobile storage shelving manufacturer.
 - 1. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.5 DEMONSTRATION/TRAINING

- A. Schedule and conduct demonstration of installed equipment and features with Owner's personnel.
- B. Schedule and conduct maintenance training with Owner's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end user personnel would normally perform.

3.6 PROTECTION

- A. Protect system against damage during remainder of construction period. Advise Owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION 10672

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DIVISION 10 - SPECIALTIES

SECTION 10800A

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 - 2.2.11 Paper Towel Dispenser
 - 2.2.12 Combination Toilet Seat Cover/Tissue Dispenser/Waste Receptacle (TSCTDWR)
 - 2.2.13 Electric Hand Dryer

PART 3 EXECUTION

- 3.1 INSTALLATION
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-- End of Section Table of Contents --

SECTION 10800A

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 (1991; R 1997) Flat Glass

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380 (Rev A)(Canc. Notice 1) Dispenser, Paper Towel

CID A-A-2398 (Rev BC); (Canc. Notice 1 Curtain, Shower and Window (Metric - SI)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-03 Product Data

Finishes:~~C A/E~~

Accessory Items:~~C A/E~~

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

SD-04 Samples

Finishes:~~C A/E~~

Accessory Items:~~C A/E~~

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

SD-10 Operation and Maintenance Data

Electric Hand Dryer:~~C A/E~~

Four complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns and repairs. Instructions shall include simplified wiring and control diagrams and other information necessary for unit maintenance.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated. Each accessory item shall be complete with the necessary mounting plates and shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall be of tamperproof design and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Grab Bar

Grab bar shall be 18 gauge, 32 mm OD Type 304 stainless steel. Grab bar shall be form and length as indicated. Concealed mounting flange shall have mounting holes concealed. Grab bar shall have stainless steel satin finish. Installed bars shall be capable of withstanding a 2.225 kN vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar shall be 38 mm.

2.2.2 Mirrors, Glass

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 6 mm thick conforming to ASTM C 1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.3 Combination Paper Towel Dispenser/Waste Receptacle Units

Dispenser/receptacle shall be recessed and shall have a capacity of 600 sheets of C-fold, single-fold, or quarter-fold towels. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 68 L. Unit shall be fabricated of not less than 0.8 mm stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided.

2.2.4 Sanitary Napkin and Tampon Dispenser

Sanitary napkin and tampon dispenser shall be surface mounted. Dispenser, including door shall be Type 304 stainless steel and shall dispense both napkins and tampons with a minimum capacity of 20 each. Dispensing mechanism shall be for coin operation. Coin mechanisms shall have minimum denominations of 25 cents. Doors shall be hung with a full-length corrosion-resistant steel piano hinge and secured with a tumbler lock. Keys for coin box shall be different from the door keys.

2.2.5 Shower Curtain

Shower curtain shall conform to CID A-A-2398, Style I, size to suit conditions. Curtain shall be anti-bacterial nylon/vinyl fabric.

2.2.6 Shower Curtain Rods

Shower curtain rods shall be Type 304 stainless steel 32 mm OD by 1.24 mm minimum straight to meet installation conditions.

2.2.7 Folding Shower Seats

Provide heavy-duty hinged seat designed to fold up against wall when not in use with stainless-steel support braces, hinges, frame, and fasteners; of all-welded construction; and complying with the following:

Configuration: L-shaped seat, designed for wheelchair access or rectangular seat, where indicated on the drawings.

Seat Material: Phenolic or polymeric composite of stat-type or one-piece construction. Color as selected by Architect from manufacturer's full range.

2.2.8 Soap Dispenser

Soap dispenser for labs shall be surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 1.2 L with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

Soap dispenser for toilets and showers shall be surface-mounted, liquid type consisting of a horizontal tank with holding capacity of 1183 ml with stainless-steel piston, springs, and internal parts designed to dispense soap in measured quantity by pump action; and stainless-steel cover with unbreakable window-type refill indicator. Soap valve shall be designed for dispensing soap in liquid form.

2.2.9 Shelf, Metal, Heavy Duty

Heavy duty metal shelf shall be minimum of 18 gauge stainless steel with hemmed edges. Shelves over 750 mm shall be provided with intermediate supports. Supports shall be minimum of 16 gauge, shall be welded to the shelf, and shall be spaced no more than 750 mm apart.

2.2.10 Robe Pin

Robe pin shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 100 mm. Design shall be consistent with design of other accessory items. Finish shall be satin.

2.2.11 Paper Towel Dispenser

Provide stainless-steel paper towel dispenser, surface-mounted type, sized for minimum of 300 C-fold or 400 multifold paper towels without using special adapters; with hinged front equipped with tumbler lockset; and with refill indicators that are pierced slots at sides or front.

2.2.12 Combination Toilet Seat Cover/Tissue Dispenser/Waste Receptacle (TSCTDWR)

Toilet seat cover, tissue dispenser, and waste receptacle combination shall be stainless steel and shall be partition mounted, dual access or wall mounted. Dispenser shall have a minimum of 500 seat covers and 2 per side standard tissue rolls. Waste receptacle at women's units for sanitary napkin disposal shall have a reuseable liner of type standard with the receptacle manufacturer. Capacity of receptacle shall be standard. Locking mechanism shall be tumbler key lock.

2.2.13 Electric Hand Dryer

Electric hand dryer shall be wall mounted and shall be designed to operate on 110/125 volts, 60 cycle, single phase alternating current with a heating element core rating of not more than 2100 watts. Dryer housing shall be of single piece construction and shall be white porcelain enamel.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation

until acceptance.

3.2 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

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DIVISION 11 - EQUIPMENT

SECTION 11010

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07/01

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SECTION 11010

EQUIPMENT SCHEDULE

07/01

PART 1 GENERAL

1.1 SUMMARY

Provide a developed equipment schedule, based on the design master equipment list and other information derived during the material selection process. The equipment schedule as submitted shall include information relating to the following:

1. The Categories, Government Furnished, Contractor Installed; Contractor furnished, Contractor Installed; Government Furnished, Government Installed.
2. Scheduled Equipment and Materials
3. Scheduled Delivery Dates for Government Furnished, and Contractor Installed items.
4. Scheduled Completion Dates for Government Furnished, and Government Installed (only as designated).
5. Other dates as required to meet the complete ordering, delivery, and installation process

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Final Equipment Schedule; G RE

Final Equipment Schedule as detailed and prepared by the contractor, not greater than 60 days of NTP or as required to meet delivery schedule.

PART 2 NO PART 2

PART 3 NO PART 3

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DIVISION 11 - EQUIPMENT

SECTION 11020A

SECURITY VAULT DOOR

12/97

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- 1.3 SUBMITTALS
- 1.4 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 VAULT DOOR AND FRAME
- 2.2 DAY GATE
- 2.3 OPERABLE DAY GATE AND FULL-LITE GLASS VIEWING WINDOW
- 2.4 Hardware

PART 3 EXECUTION

- 3.1 INSTALLATION

-- End of Section Table of Contents --

SECTION 11020A

SECURITY VAULT DOOR

12/97

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the references publications shall be used.

FEDERAL SPECIFICATIONS (FS)

FS AA-D-00600 Door, Vault, Security

1.2 GENERAL REQUIREMENTS

The vault door unit shall be a steel security-vault type door with frame, day gate, and ramp type threshold, and shall be a standard product of a manufacturer specializing in this type of fabrication.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Vault Door and Frame

Manufacturer's catalog data including catalog cuts and brochures. The data shall show that the proposed vault door unit conforms with the requirements in FS AA-D-00600, and has been tested and approved by the General Services Administration (GSA).

Shop drawings on full light glass viewing window.

SD-07 Certificates

Vault Door and Frame

Certification shall state that vault-door units that do not bear the GSA label are constructed to Class 5 standards.

SD-10 Operation and Maintenance Data

Data intended to be incorporated in operations and maintenance manuals.

SD-11 Closeout Submittals

Ten (10) year warranty and one (1) year installation warranty shall be provided.

1.4 DELIVERY AND STORAGE

Door and frame assemblies shall be delivered to the jobsite in a protective covering with the brand and name clearly marked thereon. Materials delivered to the jobsite shall be inspected for damage, and unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspection and handling. Door assemblies shall be stored off the floor on nonabsorptive strips or wood platforms. Damage to doors and frames shall be prevented during handling. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 VAULT DOOR AND FRAME

Design and construction of the door and frame assembly shall conform to FS AA-D-00600. The door shall be Class 5, Type S as indicated on the drawings.

2.2 DAY GATE

The day gate shall be the manufacturer's standard product designed for use with the vault door furnished, and shall provide access control and visual security. The gate shall be hinged on the same side as the vault door, shall swing into the vault, and shall have a locking device operable from outside by key and from inside by knob or handle.

2.3 OPERABLE DAY GATE AND FULL-LITE GLASS VIEWING WINDOW

Use glass type A with welded frame integral with the vault door frame. Factory weld outside frame to render the frame as stringent as those for the door themselves. Provide a wire mesh 200 mm square area for voice interaction.

2.4 Hardware

Provide electronic hardware by Mashamilton CDX08 or equal. Provide strike 3-coordinator swing for the double vault door.

PART 3 EXECUTION

3.1 INSTALLATION

The vault door assembly shall be installed in strict compliance with the

printed instructions and drawings provided by the manufacturer. The day gate shall be installed in a manner that will not interfere with operation of the release handle on the inside of the vault door. After installation, the door, the locking mechanism, and the inner escape device shall be adjusted for proper operation.

-- End of Section --

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SECTION 11022A

DOORS; FIRE-INSULATED, RECORD-VAULT

12/88

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- 2.1 VAULT DOOR UNIT
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 - 2.1.2 Locks
 - 2.1.3 Frame
 - 2.1.4 Day Gate

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- 3.1 INSTALLATION

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SECTION 11022A

DOORS; FIRE-INSULATED, RECORD-VAULT
12/88

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the referenced publications shall be used.

UNDERWRITERS LABORATORIES (UL)

UL 140	Relocking Devices for Safes and Vaults
UL 155	Test for Fire Resistance of Vault and File Room Doors
UL 768	Combination Locks

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Vault Door Unit

Manufacturer's descriptive data and catalog cuts.

Preprinted installation instructions.

SD-07 Certificates

Doors

Certificates certifying that the vault-door unit furnished under this specification conforms to the requirements of the Underwriters Laboratories. The label or listing of the Underwriters Laboratories, for fire-resistance classification and safety-relocking devices will be acceptable as sufficient evidence that the vault-door unit conforms to these requirements. In lieu of such label or listing, a written certificate from any

nationally recognized testing agency adequately equipped and competent to perform such services may be submitted, stating that the vault-door unit has been tested and that this unit conforms to the requirements listed herein, including methods of testing of the Underwriters Laboratories, Inc.

SD-10 Operation and Maintenance Data

Data intended to be incorporated in operations and maintenance manuals.

PART 2 PRODUCTS

2.1 VAULT DOOR UNIT

Vault door unit shall be an insulated, steel, flat-sill, record-vault-type door with frame and shall be a standard product of a manufacturer specializing in this type of construction.

2.1.1 Doors

Design and construction of doors shall be manufacturer's standard and shall have a UL 155 fire-resistant classification for a 2-hour exposure rating. Doors shall be of the size indicated. The finish for door, frame, and hardware shall be the manufacturer's standard for the type door indicated. Each door shall be equipped with a relocking device conforming to UL 140. The door shall be equipped with an inner escape device which will permit the bolt work to be released from inside the vault. Printed instructions for operating the escape device shall be provided inside the vault near the escape device release. There shall be not less than 5 bolts for the door. Each bolt shall be not less than 17 mm in diameter. When the bolts are not located on both jamb sides of the door, the jamb side not provided with bolts shall interlock with the frame walls of that side. Each door shall have not less than three heavy, offset roller bearing steel hinges. Exposed hinge pins shall be pinned, spot welded or otherwise secured to prevent removal and hinge mounting screws may not be exposed to the outside of the room.

2.1.2 Locks

Each door shall have a combination lock that complies with UL 768, Group 1R, for combination locks. The locking mechanism shall be operated by means of a lever handle. Locks shall be combination 3 tumbler, key or hand-changing type with a metal case, and shall be protected by a drill-resistive steel plate. The front-plate of the doors shall be not lighter than 1.5 mm steel plate either riveted or welded to the edge plates. Edge plates and back plates of doors shall be of not lighter than 0.81 mm steel.

2.1.3 Frame

The frame shall be of the tongue-and-groove interlocking type constructed of not lighter than 1.2 mm cold-formed steel, formed from a single length for each jamb and a single length for the soffit. Soffit and jambs shall

be continuously welded along the entire intersection. Sills shall be flat and not less in width than the jambs. Frame jambs and soffit shall be insulated with the same material as the door. The frame shall be designed for the thickness of vault wall indicated.

2.1.4 Day Gate

The day gate shall be the manufacturer's standard product designed for use with the vault door furnished, and shall provide access control and visual security. The gate shall be hinged on the same side as the vault door, shall swing into the vault, and shall have a locking device operable from outside by key and from inside by knob or handle.

PART 3 EXECUTION

3.1 INSTALLATION

The vault door unit shall be installed in compliance with the approved installation instructions. After installation, the door, the locking mechanism, and the inner escape shall be adjusted for proper operation.

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DIVISION 11 - EQUIPMENT

SECTION 11163

DOCK LIFT (SCISSORS TYPE)

08/00

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SECTION 11163

DOCK LIFT (SCISSORS TYPE)

08/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI MH29.1 Safety Requirements of Industrial Scissors Lift.

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.2.2 Nameplates

As a minimum, each loading dock lift shall have the manufacturer's name, address, type or style, model or serial number, rated capacity, and catalog number on a plate secured to the equipment.

1.2.3 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualification Documentation

Submit documentation of experience indicating compliance with specified qualification requirements.

SD-02 Shop Drawings

Scissors Type Dock Lift.

Drawings with complete wiring, schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detail drawings shall show proposed layout and anchorage of equipment and appurtenances. Detail shall show method of mounting and anchoring; and location of control stations and disconnect switches. Drawings shall show details of required pit or foundation construction and dock bumpers and structural shapes installation. Indicate remotely located power unit and space requirements.

SD-03 Product Data

Scissors Type Dock Lift

Data including a complete list of equipment and materials, manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions.

SD-06 Test Reports

Scissors Type Dock Lift

Report from approved Independent Testing Agency indicating compliance of Dock Lift with requirements of ANSI MH29.1.

SD-07 Certificates

Scissors Type Dock Lift

Manufacturer's certificate that Products meet or exceed specified requirements.

SD-10 Operation and Maintenance Data

Scissors Type Dock Lift

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set shall be furnished prior to performance testing and the remainder shall be furnished upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model

number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. After approval of the detail drawings, and not later than two months prior to the date of beneficial occupancy, spare parts data for each different item of material and equipment specified are required. The data shall include a complete list of parts and supplies, with current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 year(s) of service. Also include the name, phone number, and address of nearest authorized representative.

1.4 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:

1. Advance Lifts, Incorporated, St. Charles, IL (800)843-3625.
2. Autoquip Corporation, Guthrie, OK (405)282-5200.
3. Blue Giant Corporation, Pell City, AL (800)872-2583.
4. Pentalift Equipment Corporation, Buffalo, NY (519)763-3625.

Other products are acceptable based on the quality meeting that of the above products.

2.2 MATERIALS

2.2.1 Models

1. Advance: 2500K
2. Autoquip: PLT-C Scissors Lift
3. Blue Giant: ED5/72x96
4. Pentalift: HEDG85

2.2.2 Description

Stationary single-scissors-type hydraulic dock lift designed for permanent, recessed, installation in preformed concrete pit as indicated on drawings. Rated lifting capacity of 2268 kg. Roll-over capacity of 4535.9 kg. Vertical travel minimum 1.27 m. Travel speed 3.66 m, up or down. Lowered height maximum 203.2 mm. Platform size 1.83 m x 2.44 m long. Travel alarm with bell volume control. Alarm bell to be remote mounted on wall next to lift pit. Provide remote amber flashing warning light mounted on wall next

to pit. NOTE: light and bell must activate 5 seconds prior to movement of lift unit. Provide dock bumpers of the type and at the locations indicated on the drawings.

2.3 FABRICATION

2.3.1 Construction

Fabricate from structural steel shapes rigidly welded and reinforced to withstand deformation during operating and stored phases of service. Provide mounting brackets and removable lifting eyes.

2.3.2 Platform

Fabricate from heavy steel plate with beveled toe guards on all four sides complying with requirements of ANSI MH29.1. Provide matching hinged throwover bridge where indicated, and removable handrails. Surface shall be non-skid safety tread deck plate.

2.3.3 Hinged Bridge

Provide hinged bridge bolted to full length heavy-duty piano type hinge welded to toe guard at end of the platform. Provide bridge complete with heavy-duty lifting chains. Chamfer edge of the bridge to prevent obstruction of material handling vehicle wheels. Bridge material shall be non-skid safety tread aluminum plate. Bridge shall be one piece aluminum 1.68 m wide x 0.61 m long.

2.3.4 Handrails

Removable handrails on two sides of platform with single removable link chain across each end. Handrails 1050 mm high with midrail and 101.6 mm kickplate bottom. Mount rail sockets flush with platform surface.

2.3.5 Scissor Mechanism

Fabricate leg members from heavy steel formed tube or plate.

2.3.6 Cylinders

Equip with minimum two heavy-duty high pressure hydraulic ram type cylinders. Rams shall be either direct displacement plunger or rod and piston type with positive internal stops as standard with the manufacturer. Cylinder rods shall be chrome plated and polished to prevent rust.

2.3.7 Bearings

Provide pivot points with permanently lubricated anti-friction bushings or sealed ball bearings for minimum maintenance.

2.4 OPERATION

Self-contained electric hydraulic power unit for raising and lowering of

the lift, controlled from a remotely located push-button station.

2.4.1 Electrical Requirements

1 phase, 208 volts, 60 hertz.

2.4.2 Power Unit

Self-contained, remotely located power unit of proper size, type and operation needed for the capacity of the lift indicated. Power unit shall consist of a continuous duty motor, high pressure gear pump, valve manifold, oil line filters and oil reservoir. The manifold shall contain a relief valve, check valve, pressure compensated flow control valve and down solenoid valve and provisions for lowering the lift manually in case of power failure. Oil line filters shall include one for the oil reservoir, one for the valve manifold and one for the lift itself. Provide a pressure compensated flow control to limit down speed.

2.4.3 Remote Control Station

Provide lift unit with a weatherproof multiple-button control station of the constant pressure type, complete with "Up" and "Down" push buttons. The controller shall consist of a magnetic motor starter with three pole adjustable overloads and a 24 volt control transformer with a 4 amp fused secondary prewired to terminal strips and mounted in a gasketed NEMA 12 oil and dust tight industrial enclosure. Control shall be detachable and ceiling mounted. Equip unit with the manufacturer's standard adjustable upper travel limit.

2.4.4 Safety Devices

Provide hinged safety maintenance bars and chain closure.

2.5 FINISH

Baked enamel finish system over steel surfaces which have been cleaned and pretreated to obtain optimum paint bond. Paint toe guards yellow with black diagonal stripes and, unless otherwise indicated, paint the remainder of the surfaces Safety Yellow. Provide warning labels in accordance with ANSI MH29.1.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Execution Requirements

Verification for existing conditions before starting work.

3.1.2 Verifications of Conditions.

Verify that field measurements, surfaces, substrates and conditions are as required and ready to receive work.

3.1.3 Adverse Conditions

Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the work of this section. Do not proceed with work until unsatisfactory conditions have been corrected.

3.1.4 Responsibility for Conditions

By beginning work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 INSTALLATION

Install unit in prepared opening in accordance with manufacturer's published instructions, ANSI MH29.1, and as indicated on the drawings. Set square and level. Anchor unit securely. Make electrical connections as specified in Division 16.

3.3 CONSTRUCTION

Coordinate forming of pit for hydraulic dock lifts to ensure that the pit depth is adequate to accommodate the lift in proper relationship to the loading platform. Attach the lift securely to the pit floor in accordance with the manufacturer's directions.

3.4 FIELD QUALITY CONTROL

Comply with Section 01451A - Contractor Quality Control: Field testing and inspection. Inspect unit connection to structure and to electrical service. Perform operational tests of unit in the presence of the Contracting Officer. Demonstrate each function of operation.

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SECTION 11401

ELECTRIC KITCHEN EQUIPMENT

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SECTION 11401

ELECTRIC KITCHEN EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167 (1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 96 (1998) Ventilation Control and Fire Protection of Commercial Cooking Operations

NSF INTERNATIONAL (NSF)

NSF 2 (1996) Food Equipment

UNDERWRITERS LABORATORIES (UL)

UL 197 (1993; R 1998) Commercial Electric Cooking Appliances

UL 250 (1993; R 1998) Household Refrigerators and Freezers

UL 430 (1994; R 1996, Bul. 1996) Waste Disposers

UL 710 (1995; Bul. 1996) Exhaust Hoods for Commercial Cooking Equipment

UL 749 (1997) Household Dishwashers

UL 858 (1993; R 1999) Household Electric Ranges

UL 921 (1996) Commercial Electric Dishwashers

UL 923 (1995; R 1998) Microwave Cooking Appliances

UL 1086 (1996; R 1998) Household Trash Compactors

1.2 RELATED REQUIREMENTS

Section 15050, "Basic Mechanical Materials and Methods," applies to this section, with additions and modifications specified herein.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-03 Product Data

Kitchen equipment

SD-08 Manufacturer's Instructions

Kitchen equipment

SD-10 Operation and Maintenance Data

Kitchen equipment, Data Package 2;

Submit operation and maintenance data in accordance with Section 01700, "Operation and Maintenance Data."

PART 2 PRODUCTS

2.1 KITCHEN EQUIPMENT

2.1.1 Materials

Except as modified herein, provide manufacturer's standard materials for kitchen equipment. Provide quantities, physical dimensions, colors, and electrical characteristics as indicated.

2.1.1.1 Stainless Steel

ASTM A 167, 18-8 Composition, Type 302 or 304 or 316, with a No. 4 finish on the exposed face.

2.1.2 Refrigerator

UL 250, refrigerator with frostproof top or side by side freezer (as indicated on the drawings), minimum 0.70 cubic meter, automatic defrosting, two vegetable bottom baskets, four adjustable shelves, two door shelves and minimum 12 egg container in the door, separate interior shelves, multiple door shelves, and two ice trays. For refrigerator with top freezer, provide reversible (left swing and right swing interchangeable) doors. Provide four fixed rollers or adjustable leg levelers.

2.1.3 Over The Range Microwave Oven/Hood

UL 923, combination unit designed for under cabinet and over range installation, with black glass window door, minimum .04 m3 capacity,

automatic oven light, browning element, 10 power levels, automatic temperature controllers, minimum two automatic memory levels, digital time controllers, electronic touch-control panel, two washable grease filters, two charcoal filters, and recirculating 5-speed fan. Unit width shall match free standing range.

2.1.4 Trash Compactor

UL 1086, under counter model with storage compartment and 76 liter trash disposable bag, reversible front panel, odor control, minimum 900 kilograms ram force delivering constant and balancing pressure, and safety start lock with removable key knob guard.

2.1.5 Free-Standing Range

UL 858, freestanding electric range with four-burner cooktop and oven with broiler. Cooktop is recessed, hinged, tilt-up, porcelain enamel, with removable chrome-plated drip pan and chrome-plated trim ring on each burner. Self-cleaning oven with porcelain-enamel interior with four rack levels; two tilt-proof, chrome-plated, self-locking oven racks. Removable, full-width storage drawer below oven with porcelain-enamel front panel.

2.1.5.1 Control Panel

Porcelain-enamel combination surface-burner/oven control panel mounted above backsplash at rear of cooking surface. Include burner "ON" indicator light, automatic oven timer, and electronic digital dial clock. Controls shall be push-to-turn type with removable knobs.

2.1.6 Dishwasher

UL 921, with detergent dispenser. Provide automatic control to cycle machine through wash, rinse, dry or heat, and stop phases. Include manual setting to repeat or skip phases of cycle. Equip machine with safety switch which automatically stops spraying action when door is open. For heavy duty dishwasher, provide stainless-steel commercial grade with approximately 300 -dish capacity per hour and 540 -glasses per hour ratings.

2.1.7 Ice Maker

Free standing, undercounter, automatic ice maker. 22.68 kg daily capacity, with 11.34 kg ice storage bin. On, off operation, clean cycles, and automatic shut-off. Electronic push pad controls. Provide ice scoop and interior light.

2.1.8 Finishes

All appliances are to be finished with stainless steel on all exposed surfaces and doors, aluminum on unexposed surfaces. Aluminum with two coats of white, baked-on enamel paint.

PART 3 EXECUTION

3.1 INSTALLATION

NFPA 70, Section 15400, "Plumbing Systems." Install kitchen equipment in accordance with manufacturers' instructions.

3.2 FIELD QUALITY CONTROL

Conduct inspection and testing in the presence of the Contracting Officer.

3.2.1 Field Inspection

Before and after installation, inspect each piece of kitchen equipment for compliance with specified requirements.

3.2.2 Operation Tests

Upon completion, but before final acceptance, perform operation tests on each piece of equipment to determine that components, including controls, safety devices, and attachments, operate properly and in accordance with specified requirements.

-- End of Section --

SECTION 11470

DARKROOM EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of darkroom equipment is shown on drawings and as specified herein. A portion of the darkroom equipment work is furnished by the Owner. The responsibilities and duties of the Contractor are specified below. Darkroom equipment included in this specification include:

1. Plastic laminate cabinets.
2. Fiberglass and stainless steel sinks.
3. Safelights.
4. Tray processing sinks.
5. Silver recovery systems.
6. Acid neutralization / dilution tank.
7. Water control panels.
8. Filter panels.
9. Enlarger work stations.
10. Chemical shelves.
11. Revolving darkroom doors.

- B. Related Sections:

1. Division 5 "Miscellaneous Metal" for angles supporting safelights.
2. Mechanical Work: Division 15.
3. Plumbing Work: Division 15.
4. Electrical Work: Division 16.

1.2 DEFINITIONS

- A. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than (1200 mm) above floor, and visible surfaces in open cabinets or behind glass doors.

1. Ends of cabinets, including those installed directly against walls or other cabinets, shall be considered exposed.
2. Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets after installation shall not be considered exposed.

- B. Semi exposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases (1980 mm) or more above floor are defined as semi exposed.

- C. Concealed portions of cabinets include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

1.3 PROJECT SITE CONDITIONS

- A. Site Access. Provide access for vehicle delivery. Keep receiving area and corridors clear of materials and work to allow access to installation areas.
- B. Building Finish. Prior to delivery of darkroom equipment, conduct a review of the facility to confirm that the following requirements are met. To ensure an orderly installation and to minimize damage to equipment, complete the listed final building systems:
 - 1. Environmental Conditions: Complete exterior envelope including roofing, wall systems, exterior glazing, joint sealers, doors, interior walls, finishes, HVAC, sprinkler, plumbing, electrical systems to protect equipment from the temperature, humidity, construction activity, elements and to provide security for stored equipment.
 - 2. Certify floor level tolerances as specified in Division 9, allowing an even surface for equipment installation.
 - 3. Install interior floor finish, painted walls, ceiling grid and panels.
 - 4. Branch electrical circuits and grounding conductors.
 - 5. Air conditioning system with diffusers.
 - 6. Sprinkler lines with heads.
 - 7. Lighting.
 - 8. Mechanical lines including tests for leaks.
 - 9. Cold weather: provide temporary or permanent heat to maintain ambient room temperatures in a range of 13-20 degrees C.
 - 10. Provide temporary or permanent electric power to rooms for equipment installations.
 - 11. Rough-in connections to equipment: Coordinated with the Approved Shop Drawings for service, size and location; allowing for Final Hook-up and Connections.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver darkroom equipment only after wet operations in building have been completed. Schedule activities in such a manner that the condition of the building does not delay the delivery and installation of equipment.
- B. Installation drawings: Shall be provided by the supplier to the Contractor showing installation requirements for equipment. Drawings shall indicate elevations of units, detail sections to scale, fastenings, methods of installation and anchorage, and size and spacing of anchors. Provide manufacturer's preprinted installation instructions for revolving doors.
- C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.5 REFERENCES

- A. SEFA 8 Laboratory Furniture Casework, Shelving and Tables; Recommended Practices.
- B. NEMA LD 3B (1995) High Pressure Decorative Laminates.
- C. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.
- D. ANSI A208.1B 1993: Particleboard.

1.6 SUBMITTALS

- A. Submit the following in accordance with Section 01330 "Submittal Procedures."
- B. SD-02 Shop Drawings:
 - 1. Cabinets, Sinks, Enlarger Work Stations, Shelving, and Revolving Doors; G, A/E.
 - 2. Shop drawings shall indicate utilities required.
 - 3. The Contractor may proceed with rough-in utilities upon receipt of approved equipment installation drawings that are signed and dated by the Reviewer.
- C. SD-03 Product Data:
 - 1. Safelights, Silver Recovery Systems, Water Control Panels, Filter Panel, and Revolving Doors; G, A/E.
- D. SD-04 Samples: Submit manufacturer's standard color samples.
- E. SD-08 Manufacturer's Instructions:
 - 1. Tray Processing Sink, Acid Neutralization / Dilution Tank, Silver Recovery Systems, Water Control Panels, Filter Panel, and Revolving Doors; G, A/E.
- F. SD-10 Operation and Maintenance Data:
 - 1. Cabinets, Sinks, Safelights, Tray Processing Sinks, Water Control Panel, Filter Panel, and Revolving Doors; G, A/E.

1.7 QUALITY ASSURANCE

- A. Single source responsibility for all darkroom equipment.
- B. Manufacturer's Qualifications: 5 years in the manufacturer of the equipment specified.

1.8 WARRANTY

- A. Provide a 1-year warranty against defects in materials and workmanship.
- B. Sink Warranty: Two years.

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE CABINETS

- A. Panels, Countertops and Shelves: Exposed exterior surfaces and semi-exposed surfaces shall be decorative high-pressure laminate permanently bonded under pressure to both surfaces of a suitable substrate.
 - 1. Chemical-Resistant Plastic Laminate: Provide product for countertops and shelves that complies with grade specified above and has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, formaldehyde (37 percent), furfural, hydrochloric acid (37 percent), hydrofluoric acid (48 percent), nitric acid (30 percent), phosphoric acid (85 percent), sodium hydroxide (20 percent), sulfuric acid (33 percent), toluene, and zinc chloride.
 - 2. Color: Manufacturer's standard colors.

2.2 CABINET FABRICATION

- A. End panels, cabinet bottoms, wall cabinets, backsplashes, vertical dividers, horizontal rails, vertical rails, removable backs, exposed finished back panel, toe kicks, shelves, drawer fronts, doors, filler panels, and wall cabinet hanging cleats to be plastic laminated panels.
 - 1. Panel thickness: 13 mm.
 - 2. Exposed edges shall be self-edged with black PVC edge banding, resistant to all normal laboratory reagents.
- B. Cabinet joints shall be rabbeted, glued, and attached with screws.
- C. Hinged doors, drawers, and face panels factory attached in an overlay design.
- D. Shelves adjustable on 60 mm centers, furnished with clips capable of securing the shelf in a fixed position.
- E. Base unit assembly supplied with adjustable leveling legs for each 1200 mm of base.
- F. Drawer Box: Kiln dried hardwood, 11 mm nominal thickness.
- G. Drawers installed with nylon roller, ball bearing, metal slides. Provide positive cushion stops for permanent alignment and quiet operation.

H. Cabinet hardware:

1. Hinges: Fully concealed nickel-plated with an opening angle of 175 degrees. Adjustable for door alignment on frameless box construction.
2. Pulls: Black plastic, 100 mm long, 25 mm deep.
3. Drawer slides: Ball bearing type with 45 kg capacity.

2.3 COUNTERTOPS

- A. General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly rounded edges. Provide front and end overhang of 25 mm, with continuous drip groove on underside 13 mm from edge.

1. Countertop Core: Hardwood-faced plywood, medium-density-overlaid plywood, or particleboard complying with ANSI A208.1, Grade M-2, Exterior Glue.
 - a. Thickness: 28 mm with 0.5 mm thick backer sheet on bottom surface.
2. Finish front edges of countertops, faces and top edges of backsplashes and end splashes, and ends of countertops and splashes with same plastic laminate as top.
3. Construct top and backsplash from one piece of plastic laminate with rolled front and top edges and coved intersection. Provide separate end splashes of same material as top, fitted to top, where indicated. Finish exposed ends with same plastic laminate as top.

2.4 FIBERGLASS SINKS

- A. Work surface: Polyester resin.
- B. Reinforcement: Glass fiber, not less than 40 percent or more than 60 percent by weight of the completed unit.

2.5 DUPLEX SAFELIGHTS (DUB and DUC)

- A. The safelight is plugged into a ceiling electrical outlet and controlled by a wall switch.

1. Features:
 - a. Size: 410 mm long x 290 mm wide x 240 mm high.
 - b. Provide two mounting eyebolts or "S" hooks 375 mm apart for suspending from ceiling.
 - c. Support chains for suspending from ceiling.
 - d. Provide fixture types for black and white print papers, and color printing papers, as indicated on the drawings.

2.6 ILLUMINATED WARNING SIGN (ILSD/SL)

- A. Standard model with the words IN USE on the face.
 - 1. Features:
 - a. Aluminum construction.
 - b. Size: 175 mm wide x 100 mm deep x 125 mm high.

2.7 TRAY PROCESSING SINKS

- A. Sink processing deck assembly constructed of polyester resin, laminated glass fiber mat, and a storage base with leveling legs constructed of high density plastic laminated particle board.
- B. Refer to drawings for locations of units equipped with fume exhaust systems.
- C. Factory equip each sink with the following fittings:
 - 1. Hot and cold combination faucet and spray hose.
 - 2. Gooseneck faucets with vacuum breaker and hose connection.
 - 3. Water temperature blender with thermometer.
 - 4. Total water filtration system.
 - 5. Jet sprays with control valve and vacuum breaker.
 - 6. Standpipe basket strainer.
 - 7. Fume exhaust slot vent system.
- D. Dimensions: Where indicated on the drawings, provide units of the following sizes:
 - 1. Overall: 825 mm x 1875 mm x 1150 mm high.
 - 2. Overall: 610 mm x 1210 mm x 1150 mm high.
 - 3. Rim height: 975 mm above finished floor.
 - 4. Processing area: 625 mm x 1875 mm x 125 mm deep.
 - 5. Processing area: 425 mm x 1210 mm x 125 mm deep.

2.8 SILVER RECOVERY SYSTEM

- A. Silver recovery system including re-settable external hours counter, adjustable metering feed pump, 28 liter capacity, quick connect fittings, pressure relief valve, audible cartridge change alarm, secondary containment drip tray, pump on indicator, and programmable volume counter.
- B. Unit Dimensions: 670 mm high x 600 mm wide x 540 mm deep.
- C. Electrical Requirements: 120 VAC, single phase, 20-amps.

2.9 ACID NEUTRALIZATION / DILUTION TANK

- A. Unit constructed of high-density polyethylene, designed to neutralize harmful acids and precipitates into sludge causing it to fall to the bottom of the unit. Provide limestone chips (approximately 23 kg).

- B. Features:

- 1. Tank capacity: 20 liters.
 - 2. Dimensions: 275 x 350 mm.
 - 3. Wall thickness: 5 mm.

2.10 WATER CONTROL PANEL

- A. Unit designed to automatically blend hot and cold water supplies to required process temperatures.

- B. Features:

- 1. Adjustable graduated flow meter.
 - 2. Built-in water filter.
 - 3. Clean up spigot.
 - 4. In-line thermometer.
 - 5. Dimensions: 325 mm high x 850 mm wide.

2.11 FILTER PANEL

- A. Hot and cold filter mounted in line preceding the plumbing package on sinks. Includes polypropylene filter media on polypropylene core.

- B. Features:

- 1. Maximum temperature: 71 degrees C.
 - 2. 25-micron filter.
 - 3. Filter size: 240 x 62 x 25 mm.

2.12 STAINLESS STEEL SINK

- A. Self-rimming cornered construction, with insulated mastic underlayment.

- B. Sink Pan: 16 gauge type 316 stainless steel. No. 4 finish.

2.13 ENLARGER WORK STATIONS

- A. Enlarger station comprised of a projection easel support counter with a 100 mm high rear curb and adjustable easel sector with leveling supports.

- B. Construction: High density wood core with all exterior surfaces of high-pressure plastic laminate.

- 1. Dimensions: 1050 mm wide x 900 mm high x 725 mm deep.

2. Color: Black.

2.14 CHEMICAL SHELVES

- A. Stainless steel shelf designed to hold chemical containers above the sink. Provide side guards to contain spills and release to the sink below via an integral drain tube assembly.
 1. Construction: All joints heliarc welded, passivated, ground smooth and polished to a no. 4 finish.
 2. Size: 450 mm deep x 1200 mm long with 38 mm high splash guards.
 3. Accessories:
 - a. Stainless steel shelf brackets at 800 mm centers.
 - b. 13 mm diameter vinyl tubing, 900 mm long.

2.15 REVOLVING DARKROOM DOORS

- A. Provide revolving darkroom doors in sizes and configurations shown on the drawings. Units shall be wheel chair accessible, unless noted otherwise. Units shall be light tight.
 1. Doors shall be 2-way or 3-way type, as indicated, with the outer cylinder having 2 or 3 openings, as required. The inner cylinder shall have a single entrance and rotate. The assembly shall mount to the darkroom wall and remain stationary.
 2. Equip revolving door units with breakaway hardware for emergency removal, clean up, and for moving large equipment in and out of the darkroom areas. Hardware kit shall consist of mating members, half of which will fasten to the door and the mating portion fastening to the wall. Provide freestanding fillet strip of flexible neoprene to block the light and pop-out removal.
 3. Provide revolving door units consisting of inner and outer cylinders constructed of 1 mm aluminum sheet panels with steel reinforced supporting members. Provide ball bearing center suspension and a lower guide for smooth effortless operation.
 4. Provide internal handrail curved to fit the internal circumference of the revolving door cylinder and spaced 38 mm from door cylinder wall to provide positive movement of the cylinder without regard for angle of entry.
 5. Provide external finger grips spaced 250 mm on center around the circumference of the revolving door cylinder for positive grip when rotating the door from the outside.
 6. Provide fluorescent markers permanently attached to inside of door rail and finger grips for positive locating of handrails and finger grips in the dark.
- B. Accessories:

1. Provide stationary floor with non-skid surface.
2. Provide security locks with 2 keys for each unit.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces designated to receive work for conditions that would adversely affect the finished work. Repair or replace surfaces not meeting tolerances or quality requirement governing substrate construction prior to start of work.

3.2 UTILITIES

- A. Inspect and verify that necessary utilities have been roughed in prior to equipment installation.

3.3 INSTALLATION

- A. Install in strict accordance with manufacturer's printed instructions and shop drawings. Make final utility connections, and test equipment to assure proper working order.
- B. Qualified craftsman approved by the manufacturer shall install darkroom equipment units.
- C. Set equipment items plumb, square, true to line and leveled. Securely anchor to building structure.

3.4 CLEANING

- A. Prior to final acceptance, clean soiled surfaces and repair or replace items that become damaged.

3.5 PROTECTION

- A. Protect materials and installed darkroom equipment from damage by work of other trades until the final acceptance.

3.6 ADJUSTMENTS

- A. Adjust revolving doors to ensure smooth operation.

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SECTION 11486

FIRING RANGE EQUIPMENT AND ASSEMBLIES

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SECTION 11486

FIRING RANGE EQUIPMENT AND ASSEMBLIES

09/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 (1994) Test Methods for Louvers, Dampers and Shutters

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

AA SAA-46 (1978) Standards for Anodized Architectural Aluminum

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M (1997a^{el}) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 653/A 653M (1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM C 423 Standard Specification for Testing Noise Reduction Coefficient

ASTM C 1036 (1991; R 1997) Flat Glass

ASTM C 1048 (1997b) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM C 1172 (1996^{el}) Laminated Architectural Flat Glass

ASTM D 256 (1997) Determining the Izod Pendulum Impact Resistance of Plastics

ASTM D 542 (1995) Index of Refraction of Transparent Organic Plastics

ASTM D 570	(1998) Water Absorption of Plastics
ASTM D 635	(1998) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D 638	(1998) Tensile Properties of Plastics
ASTM D 638M	(1998) Tensile Properties of Plastics (Metric)
ASTM D 648	(1998c) Deflection Temperature of Plastics Under Flexural Load
ASTM D 696	(1998) Coefficient of Linear Thermal Expansion of Plastics Between Minus 30 degrees C and 30 degrees C
ASTM D 792	(1998) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D 882	(1997) Tensile Properties of Thin Plastic Sheeting
ASTM D 905	(1998) Strength Properties of Adhesive Bonds in Shear by Compression Loading
ASTM D 1003	(1997) Haze and Luminous Transmittance of Transparent Plastics
ASTM D 1044	(1999) Resistance of Transparent Plastics to Surface Abrasion
ASTM D 1922	(1994a) Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method
ASTM D 3029	(1994) Impact Resistance of Flat Rigid Plastic Specimens by Means of a Tup (Falling Weight)
ASTM D 3595	(1997) Polychlorotrifluoroethylene (PCTFE) Extruded Plastic Sheet and Film
ASTM D 3951	(1998) Commercial Packaging
ASTM D 4093	(1995) Photoelastic Measurements of Birefringence and Residual Strains in Transparent or Translucent Plastic Materials
ASTM D 4802	(1994) Poly(Methyl Metacrylate) Acrylic

Plastic Sheet

ASTM E 84	Standard Test Method for Surface Burning Characteristic of Building Materials
ASTM E 90	(1999) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 168	(1992) General Techniques of Infrared Quantitative Analysis
ASTM E 169	(1999) General Techniques of Ultraviolet-Visible Quantitative Analysis
ASTM E 204	(1998) Identification of Material by Infrared Absorption Spectroscopy, Using the ASTM Coded Band and Chemical Classification Index
ASTM E 831	(1993) Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
ASTM E 1300	(1998) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load
ASTM F 428	(1997e1) Test Method for Intensity of Scratches on Aerospace Glass Enclosures
ASTM F 520	(1977; R 1997) Environmental Resistance of Aerospace Transparencies
ASTM F 521	(1983; R 1997e1) Bond Integrity of Transparent Laminates
ASTM F 548	(1981; R 1994e1) Test Method for Intensity of Scratches on Aerospace Transparent Plastics
ASTM F 735	(1994) Abrasion Resistance of Transparent Plastics and Coatings Using the Oscillating Sand Method
ASTM F 791	(1982; R 1996) Stress Crazeing of Transparent Plastics
ASTM F 1233	(1998) Security Glazing Materials and Systems
ASTM G 26	(1996) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1	(1997) Butts and Hinges
BHMA A156.4	(1992) Door Controls - Closers
BHMA A156.5	(1992) Auxiliary Locks & Associated Products
BHMA A156.8	(1994) Door Controls - Overhead Stops and Holders
BHMA A156.13	(1994) Mortise Locks & Latches
BHMA A156.16	(1997) Auxiliary Hardware
BHMA A156.18	(1993) Materials and Finishes

U.S. DEPARTMENT OF STATE (SD)

SD Std-01.01	(1993 Rev G Amended; Inx Certified Prod/Mfg) Certification Standard Forced Entry and Ballistic Resistance of Structural Systems
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DOOR AND HARDWARE INSTITUTE (DHI)

DHI A115.1	(1990) Preparation of 1-3/8" and 1-3/4" Standard Steel Doors and Steel Frames for Series 1000 Mortise Locks and Latches
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GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(1997) Glazing Manual
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H.P. WHITE LABORATORY (HPW)

HPW TP-0501.01	(1989) Ballistic Resistance of Structural Materials (Opaque and Transparent); Test Procedures and Acceptance Criteria
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NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 810	(1987) Hollow Metal Manual; Section: Hollow Metal Doors
NAAMM HMMA 820	(1987) Hollow Metal Manual; Section: Hollow Metal Frames
NAAMM HMMA 830	(1987) Hollow Metal Manual; Section: Hardware Preparation and Locations for Hollow Metal Doors and Frames
NAAMM HMMA 840	(1987) Hollow Metal Manual; Section:

Installation and Storage of Hollow Metal
Doors and Frames

NAAMM HMMA 850

(1983) Hollow Metal Manual; Section:
Fire-Rated Hollow Metal Doors and Frames

NAAMM HMMA 862

(1987) Hollow Metal Manual; Section:
Guide Specifications for Commercial
Security Hollow Metal Doors and Frames

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2

(1993) Industrial Control and Systems
Controllers, Contactors, and Overload
Relays Rated Not More Than 2,000 Volts AC
or 750 Volts DC

NEMA ICS 6

(1993) Industrial Control and Systems,
Enclosures

NEMA MG 1

(1998 Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(1999)

National Electrical Code

NFPA 80

(1999) Fire Doors and Fire Windows

NATIONAL INSTITUTE OF JUSTICE (NIJ)

NIJ Std 0108.01

(1985) Ballistic Resistant Protective
Materials

NAVAL FACILITIES ENGINEERING SERVICE CENTER (NFESC)

NFESC CR 80.025

(1980) Testing and Evaluation of Attack
Resistance and Hardening Retrofits of
Marine Barrack Construction Types to Small
Arms Multiple Impact Threat

UNDERWRITERS LABORATORIES (UL)

UL 752

(1995; Rev thru May 1998) Bullet-Resisting
Equipment

1.2 SYSTEM DESCRIPTION

1.2.1 Design Requirements

Firing range equipment and components shall conform to the requirements specified for the particular items and as much as possible shall be complete assemblies by a single manufacturer. Bullet recovery system shall provide for a rapid, simple, safe, and reliable means for the recovery of fired bullets free of surface damage for the use in forensic examinations. The manufacturer of the firing range equipment shall design and locate the necessary safety baffle and deflector systems, bullet recovery tank, bullet trap, target retrieval system, and acoustical baffles throughout the firing range, and coordinate them with other range equipment. Manufacturers shall design all the range equipment items to comply with seismic restraint requirements of governing codes.

1.2.2 Performance Requirements

All items specified shall be bullet resistant to the threat specified. Movable and operable components shall operate smoothly and freely. When a reference for performance is listed, operation shall conform to referenced requirements. Ratings of manufactured materials shall meet Standard of Safety UL 752. The design of the range equipment and ventilation shall comply with all OSHA requirements. Electrical work shall comply with the latest edition of the NEC. All equipment shall be UL listed and have the required UL label affixed to the equipment.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G A/E

Drawings containing complete wiring and schematic diagrams where appropriate and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of components and appurtenances, and relationship to other parts of work including clearances for operation and maintenance. Drawings sufficient to show conformance to all requirements, including fabrication details, sizes, thickness of materials, anchorage, finishes, hardware location and installation.

Coordination drawings of the range equipment showing locations of equipment and associated lights, sprinkler heads, electrical fixtures, and HVAC components.

SD-03 Product Data

Firing Range Equipment; G A/E

Acoustical Baffles; G A/E

Manufacturer's descriptive data and installation instructions, including equipment dimensions and construction, equipment capacities, physical dimensions, utility and service requirements and locations, point loads, and factory finishes. Data shall include a complete list of parts and supplies, with current unit prices and supply source.

Lists including schedule of all components to be incorporated in the work with manufacturer's model or catalog numbers, specification and drawing reference numbers, warranty information, threat level certified, fire ratings, sound transmission coefficient ratings, insulation "U" value, and number of items provided. Evidence that standard products essentially duplicate items that have been satisfactorily in use for two years or more, including name of purchasers, locations of installations, dates of installations, and service organizations.

A copy of the instructions proposed to be framed and posted.

SD-07 Certificates

Firing Range Equipment

Acoustical Baffles

Manufacturer's certificates attesting that all components conform to the requirements on drawings and in specifications. Submittal shall include testing reports from independent testing

laboratories indicating conformance to regulatory requirements.

SD-10 Operation and Maintenance Data

Firing Range Equipment

Six copies of operation and six copies of maintenance manuals for the equipment furnished. Include description of equipment operation, adjusting, and testing required. Identify system maintenance requirements, servicing cycles and spare part sources.

For bullet trap, provide documents describing specific maintenance procedures to be employed based on the type of ammunition used and the number of rounds fired. The manuals shall be approved prior to beneficial occupancy.

1.4 STANDARD PRODUCTS

Materials and components shall be the standard products of a manufacturer regularly engaged in the manufacture of such products unless otherwise indicated and detailed on the drawings, and shall essentially duplicate items that have been in satisfactory use for at least two years prior to bid opening. Components shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site, or by the manufacturer. Where components are detailed on the drawings and do not conform to a manufacturer's standard product, components shall be constructed of manufacturer's standard materials which conform to the specified ballistic standard or test.

1.5 QUALIFICATIONS

Manufacturer and installer shall have minimum 5 years specialized experience in the construction and installation of equipment listed in this Section.

1.6 COMPONENT TEST REQUIREMENTS

Firing range equipment shall be provided at locations shown on the drawings. Bullet-resistant components where indicated shall be in accordance with NIJ Std 0108.01, UL 752, and HPW TP-0501.01.

1.7 DELIVERY, STORAGE, AND HANDLING

Firing range equipment shall be delivered to the job site with the brand, name, and model number clearly marked thereon. All components shall be delivered, stored and handled so as not to be damaged or deformed, and in accordance with ASTM D 3951. Abraded, scarred, or rusty areas shall be cleaned, repaired, or replaced immediately upon detection. Damaged components that cannot be restored to like-new condition shall be replaced.

Components and equipment shall be stored in a dry location on platforms or pallets that are ventilated adequately, free of dust, water, and other contaminants, and stored in a manner which permits easy access for inspection and handling. Products shall be delivered to the job site in manufacturer's original unopened containers, crates, or protective wrappings.

1.8 WARRANTY

The firing range equipment manufacturers shall provide a warranty for a period of 2 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ELECTRICAL WIRING

Electrical wiring and conduit shall be provided as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

2.2 FINISHES

All ferrous metal components except stainless steel shall be furnished primed for painting unless indicated otherwise. Finish painting shall be in accordance with Division 9 Section PAINTING unless otherwise indicated. Aluminum items shall be finished in standard mill finish unless otherwise specified. When anodic coatings are specified, the coatings shall conform to AA SAA-46, with coating thickness not less than that specified for protective and decorative type finish in AA DAF-45. Items to be anodized shall receive a polished satin finish pretreatment and a clear lacquer overcoat.

2.3 BULLET RECOVERY TANK

The bullet recovery tank shall consist of a one-piece water-filled containment tank assembly, firing port, side closure panels, and infill floor system, exhaust duct, and a circulating, chlorinated, water filtering system, with chlorinating or algacide system. The tank shall be designed for recessed installation.

2.3.1 Ballistics Capacity

Commercially loaded handgun and rifle ammunition including armor piercing ammunition, muzzle velocity not to exceed 3500 FPS and a corresponding energy of 5,250 foot-pounds.

2.3.2 Design

The tank shall be constructed of 10 mm stainless steel at critical locations, 6 mm stainless steel elsewhere, welded one-piece construction and welded on both inside and outside. Tank shall be reinforced with 75 mm stainless steel angle bracing around the exterior at heights of approximately 508 mm and 1016 mm around the top edge. Equip tank with weapon firing port at one end and a hinged access door on the top of the tank. Interior of tank shall be provided with a waterproof light fixture designed to illuminate the interior of the tank. Finish bottom of tank with permanent white scuff-resistant and corrosion resistant mat or coating. Tank shall include an exhaust duct located at the top for a ducted connection to a remotely located exhaust blower. The tank shall rest on a series of shock absorbers of appropriate design and strength to absorb impact energy. Provide protective rubber pads between the tank and

frame components and waterproofing materials. All fasteners shall be of a lock-type that shall remain permanently tight.

The overall assembled tank dimensions, including the reinforcement angles shall be 870 mm wide by 2700 mm long by 1230 mm high. The inside dimensions of the assembled tank shall be 710 mm wide by 2525 mm long by 1200 mm high.

2.3.3 Access Door

Access to tank for bullet removal shall be provided by a power assist actuated door on top of the tank. Door shall incorporate flexible and replaceable gasketing material as a seal to prevent the escape of water, airborne lead and gunpowder residue. Provide a rotary-action hydraulic device or an electro-mechanical device to raise the door. Provide a simple manual method of raising the access door as an alternative back-up system. The closing mechanism for the access door shall be made inactive when a solid state, electronic photoelectric safety light curtain senses the presence of an obstruction during the closing cycle. The safety mechanism shall meet all OSHA safety standards.

2.3.4 Firing Port

Firing port shall be stainless steel, designed to prevent a projectile from leaving the tank, regardless of the firing angle. Firing port shall incorporate a notched nylon or similar block to rest the barrel of the firearm under test.

2.3.5 Closure Panels

Provide stainless steel closure strips to completely close the gap between the tank and the pit walls. Closure panels shall be removable to allow access to the bottom of the tank, plumbing fixtures and floor drain. Provide a reglet on the perimeter of the tank in order to seal the pit waterproofing to the working platform.

2.3.6 Exhaust System

Provide a hard ducted exhaust system for the rapid forced evacuation of all gunshot residues resulting from use of the tank, and to maintain a negative pressure inside the tank at all times, pulling air through the firing port.

The tank manufacturer shall provide a 16 gauge stainless steel duct from the top of the tank to 300 mm above the top of the concrete slab. A tank employing a recirculating air system is not acceptable.

2.3.7 Electrical Requirements

120 volt, 60 Hz, single phase, GFI, 20 Amp service.

Low voltage waterproof light fixture, 100 W minimum.

Exposed wiring or electrical work is not permitted.

All electrical controls and switches for the pump, filter, tank light, and

door openers shall be water-tight, UL approved components. The electrical system shall include a ground fault interrupter within the control loop.

2.3.8 Plumbing Requirements

Provide tank drain at the bottom of the tank with mesh strainer designed to preclude the loss of small fired bullets. Provide an accessible trap below the drain located at the firing port end.

System fill and overflow shall be such that overflow capacity will exceed fill capacity when the system is automatically filled. The tank shall have the ability to automatically fill to a user-adjustable level of 1065 mm to 1200 mm. Piping circuit must include ability to power drain or selectively gravity drain the tank.

Provide system complete with integral filtration, water circulating and algaecide system, and all necessary plumbing and electrical connections to ensure proper operation. Filter shall be suitable for both filtration and removal of lead fragments. Provide an outside the tank recirculating loop incorporating a replaceable cartridge filter and pump which will permit back-flushing of the filter and drainage tank. Interface the filtration system with a 24-hour timer control system. Provide one spare filter for future use.

2.4 WET BULLET TRAP

Trap Design: The trap shall be of steel plate construction for heavy use and high volume. The design of the wet type bullet recovery system shall consist of the following:

- a. Shallow angle entrance ramps 12 degrees for rifle sprayed with a proprietary Snail lubricated liquid.
- b. Spray bar.
- c. Circular modified deceleration chamber sprayed with lubricant.
- d. A reservoir system for the liquid.
- e. Spent bullet collection tray.
- f. Liquid return lines.
- g. Impeller pumps.
- h. In-line filters.
- i. Shooting height: 1325 mm.

2.4.1 Ballistic Rating

The rifle-rated trap shall, without allowing bullet penetration, be capable of stopping and containing all projectiles up to 13000 FPE at muzzle (no steel core, ceramic or hardened tipped bullets or AP/API, with exception of 5.56 and 7.62 NATO rounds which are mild steel core, and all ammo up to M2 /BMG steel core ball ammo).

2.4.2 Entrance Ramps

The entrance ramps of the trap shall be designed to guide the bullet into the trap without impeding its progress into the deceleration chamber. The ramp design shall not exceed 12 degrees to the horizontal for rifle-rated

traps.

- a. The entrance ramps extend from the floor to the entrance (throat) of the circular deceleration chamber. The upper ramp extends 2400 mm from the floor to the throat of the circular deceleration chamber. In the absence of range baffles, the upper ramp extends 2400 mm from finished floor level.
- b. The ramps are 13 mm rifle rated steel with a Brinell Hardness minimum of AR500 for rifle rated at 13000 FPE.

2.4.3 Custom Side Walls

9.5 mm AR235 Brinell hardness steel.

2.4.4 Customized Circular Deceleration Chamber

The circular deceleration chamber shall be designed to allow the bullet to forfeit its kinetic energy in a circular motion. The inside diameter of the chamber sized to insure the bullet continues to ride on or as close to its ogive curve as possible. By maintaining a constant curve, the bullet continues in a straight line and sustains contact on the bullet's side and not be allowed to nose into the surface, thus preventing the bullet from bouncing within the chamber. The inside of the chamber shall be readily accessible for inspection without removal of the internal deceleration medium.

- a. Provide at the bottom of the deceleration chamber a small opening running across the width of the chamber. This opening allows the liquid and spent bullet to drop out the bottom of the chamber. As the bullet makes its revolutions, it skips across the opening making contact on the opposite side at an angle of 12 degrees (for rifle).
- b. Custom Designed Deceleration chamber material shall include AR500 13 mm thick steel with a Brinell hardness of approximately 500.

2.4.5 Reservoir System

The reservoir system consists of the reservoir, tank, front trough, spent bullet tray, return lines and pumps

2.4.5.1 Reservoir

Reservoir located directly under the bottom opening of the deceleration chamber. The reservoir is rectangular in design and supports the spent bullet tray and houses the pumps. It extends the width of the trap. The reservoir holds enough liquid to maintain a steady liquid flow while the trap is in operation. Weirs are located on the bottom of the reservoir to protect pump from shotgun wads and assorted debris.

2.4.5.2 Spent Bullet Tray

Spent bullet tray fabricated from perforated steel plate forming the lid of the reservoir. Perforations sufficient in number to allow the lubricant to flow across the spent bullets and through to the reservoir, but not large

enough to allow the spent bullet material to drop into the reservoir. The spent bullets shall be easily cleaned off the tray with a small flat shovel.

2.4.5.3 Return Lines

The return lines, as part of the reservoir system, shall complete the liquid cycle. Front trough return lines provided at 2400 mm on center. The return line is a 100 mm diameter PVC pipe connected to the front trough nipple with a flexible coupling. The flexible coupling allows the PVC pipe to be adjusted on the top of the reservoir without providing a series of pipe sections or elbows.

2.4.5.4 Pumps

Pumps designed for extended or continuous use. Pumps supplied as 110 volt, single-phase, 60Hz, or 240 volts, single-phase, 60 Hz.

2.5 BALLISTIC BAFFLE SYSTEM

Combination wood, plywood, and steel plate baffles designed to safely stop and capture bullets from misdirected shots or other projectiles. Construct with continuous 38 mm air space suspended horizontally over the firing line and at 15 degree angles, or as required, throughout the remainder of the range. Provide a horizontal safety ceiling above the shooter's position. Ceiling shall be minimum 3600 mm long x width of room, and constructed same as the baffles except double layer of steel.

- a. Steel back plates: 1200 mm x 1200 mm x 6 mm, AR500 rating.
- b. Lumber nailers: 25 mm x 100 mm, kiln dried, and fire retardant in accordance with Section 06114.
- c. Front panels: 19 mm, A/C grade fire retardant plywood in accordance with Section 06114.

Provide required hardware to securely attach the baffles to the concrete ceiling. Design and install the baffles and deflectors to protect the light fixtures, power outlets, sprinkler heads, and other protrusions present throughout the firing range. Materials and assemblies shall be designed to withstand the projectile forces equal to or in excess to the requirements for the bullet trap.

2.6 TARGET RETRIEVAL SYSTEM

The system shall be automatically operated type, consisting of an overhead track, drive unit, local control station, and target carriers. Structurally supporting parts shall be cold-rolled or extruded steel.

2.6.1 Track System

The track shall be designed to provide a stable platform for the carrier to travel on. Fabricate track in 1830 mm sections designed to bolt together utilizing a 900 mm offset to provide a straight and rigid assembly. On one side of the track, mount a solid copper bus bar that is electrically isolated from the track to provide power to the carrier. Provide a solid steel pulley at the trap end for the 3 mm aircraft cable. Provide mounting

brackets to secure the track to the structure or the baffle system.

Track Sections: 11 gauge cold rolled steel, cut and brake formed, and satin coated finish. Size: 1830 mm x 127 mm x 76 mm.

Starter Section: Designed to permit quick removal of copper bus, and cutout section to allow removal of carrier without releasing tension in cable.

Support Brackets: C-shaped, with clamping bolts to hold track securely to structure.

2.6.2 Drive Unit

The drive unit shall have a low profile and shall mount overhead to the starter track section behind the shooter's position. The drive unit components shall include drive motor, variable speed motor drive module, communications module, and main interface printed circuit board with power supply. The major components shall plug in for ease of maintenance. Mount the components on 11 gauge steel platform and enclosed in an ABS molded, hinged removable cover. The target carrier downrange positioning and calibration functions shall be managed from the drive unit, and performed automatically each time it is returned to the home position. The drive unit shall not require down range sensors. The drive unit enclosure shall have a filtered fan to provide positive pressure in the housing.

Components: Industrial grade process control computer with power supply. 1/2 HP drive motor. Variable frequency drive controller.

Control: Controlled by local control screen. Multiple speed capability allows systems to be programmed for aggressor avoidance training.

Power requirements: 220 VAC, with neutral ground. Maximum 8 amps current draw.

Drive System: Variable frequency drive to allow ramped acceleration and deceleration, and electronic braking of carrier. Aircraft cable coupled directly to drive pulley resulting in positive positioning without the use of V-belts.

2.6.3 Local Control Station

Provide a local control station designed to mount at the shooter's position to control the individual target carrier. Local control screen capable of controlling the individual position.

Display: LCD, 4 lines x 20 characters. Backlit for use in all lighting environments. Water-resistant to MEMA 4 standards.

Keyboard: Membrane style with heavy overlay. Number keys, decimal point, +/-, clear, enter, and cursor control keys. Four software function keys.

Enclosure: 16 gauge steel, folded and welded. Finish in gloss black epoxy powder coat.

Operation: Commands are entered using the keypad and function keys. Allows positioning of target carrier to any selected position in 300 mm increments. Rotate target face, edge or back. Set exposure, pause, and cycle times. It shall be possible to monitor the system diagnostics at the local screen using maintenance and set-up screens. It shall be possible to password protect the maintenance screens.

2.6.4 Lighted Target Carriers

Provide a totally enclosed target carrier to prevent debris from getting inside. The target carrier shall have an AR500 bullet resistant front ballistic plate and the body shall be made of 14 gauge mild steel. Provide a halogen lamp assembly with the lamp aimed to illuminate the target. The illumination shall be under the control of the local control screen. The lamp control shall incorporate a transparent lamp switchover circuit in the event that the lamp fails. Provide a projectile raceway over the turning motor to prevent damage. The power pickup assembly in the carrier shall employ a copper/graphite composite shoe.

Target clamp: Designed to hold the target tight, but releases with a squeeze of the lever with one hand. Downrigger positions target clamp 250 mm below the carrier body.

Wheels: Slim, ball bearing style made of long-life material.

Lighting: Lamp can be turned on at any position in carrier travel. Dual lamp system to provide transparent changeover if primary lamp fails.

Turning mechanism: Provides continuous rotation through 360 degrees in either direction, providing random edging.

Mounting: Design carrier guide mechanism for easy removal of carrier from starter section.

Dimensions: 775 mm x 127 mm x 197 mm.

2.7 SIGNAGE

The range equipment manufacturer shall provide 3 metal signs which display the maximum ballistic levels permitted for use with the firing range equipment and projectile recovery tank. Signs shall be 279 mm high by 357 mm wide.

2.8 ACOUSTICAL WALL TREATMENT

2.8.1 Acoustical Wall Panels

Acoustical wall panels consisting of metal frame, faced with a perforated steel skin, with an inner PVC encapsulated fiberglass acoustical energy

absorbing material. Acoustical panels shall be washable. Locate panels at exposed walls of Firing Range as shown on the drawings. Provide complete wall assembly as detailed on the drawings. Wood nailers, plywood panels, and steel back plates shall be in accordance with article 2.5 Ballistic Baffle System.

2.8.1.1 Fire Test Response Characteristics

Provide acoustical wall panels with the following surface burning characteristics as determined by testing identical products per ASTM E 84. Identify panels with appropriate markings of applicable testing and inspection agency.

Flame Spread: 25 or less.

Smoke Developed: 450 or less.

2.8.1.2 Panel Construction

Manufacturer's standard panel construction complying with the following requirements:

Facing material: Manufacturer's standard 0.8 mm thick perforated metal with 3 mm diameter holes spaced to provide 50 percent free area. Finish to be factory primed and painted with manufacturer's standard paint system.

Thickness: Nominal overall thickness of 100 mm with an NRC of 0.90 to 1.15 and STC rating of 31 when tested in accordance with ANSI/ASTM C 423 and ASTM E 90.

Panel width: 600 mm maximum, reinforced to prevent bowing outward.

Panel height: Full height from floor to ceiling.

Metal frames: "U" shaped steel.

Sound absorbing material: Class A, encapsulated in PVC cover to permit wall panels to be washed without damaging the product; density of 1.5 pcf.

Color: To be selected by Architect from manufacturer's standard colors.

2.8.1.3 Back-Mounting Accessories

Mechanically mounted edge reinforced panels with metal panel clips and base support bracket system consisting of two-part panel clips, with one part of each clip mechanically attached to the back panels and the other to the walls substrate. Design the clips to support the panels laterally and base support brackets designed to support full weight of the panels. Allow for panel removal. Provide anchors at top, bottom, and third point of span.

2.8.1.4 Miscellaneous Accessories

Provide matching trim at cut edges of panels, at all corners, top and bottom trim pieces around door and window frames, and wherever necessary to provide a complete installation.

2.9 PISTOL LOCKERS

Provide pistol lockers in sizes and arrangement as indicated on the drawings. Module size shall be 356 mm wide by 350 mm deep by 362 mm high.

2.9.1 Fabrication

16 gauge steel phosphate treated finish with baked-on enamel. Door, sides, bottoms, and dividers shall be lined with felt for weapon's protection. Form and weld into integrated units with doors and locks installed. Lock post closed at top and bottom except slot for pry-proof cash box flange. Weld top, bottom, and sill cross members into frame uprights. Doors to be solid, flange formed, welded-on reinforcement with corrosive resistant hinge parts.

2.9.1.1 Locking Mechanism

Key operated 7 gauge slide bar with proprietary 533 Duo lock cylinder. Provide master keying system for all lockers.

2.10 ACOUSTICAL BAFFLES

Acoustical baffles shall be 100 percent open cell, fiber free panels equal to SONEXvalue line as manufactured by illbruck, inc.

2.10.1 Baffle Characteristics

The baffles shall be Class 1 fire rated with the following characteristics:

- a. Density: 1.12 kg/m³.
- b. Tensile Strength: 23.4 kg/cm².
- c. Flammability: Class 1 per ASTM E 84.
- d. Flame Spread: 10.
- e. Smoke Density: 10.
- f. Panel Size: 600 mm x 1200 mm x 50 mm.
- g. Finish: Painted in manufacturer's standard color to be selected.
- h. Sound Absorption Coefficients: Type Mountings per ASTM C 423.

2.11 ACCESSORIES

All accessories shall be provided for the installation or erection of above components into the surrounding structure. Anchorage shall be as strong and bullet-resistant as the components. Installation/erection shall be per manufacturer's recommended instructions. Adhesive for the acoustical baffles shall be non-toxic, water-based adhesive, for use with foam products, and as recommended by the manufacturer.

2.12 LABELING

Firing range equipment shall be plainly and permanently labeled in accordance with regulatory requirements. Label shall be visible only on protected side, after installation and shall include the following information:

- a. Manufacturer's name or identifying symbol
- b. Model Number, Control Number, or equivalent
- c. Date of manufacture by week, month or quarter and year. This may be abbreviated or be in a traceable code such as the lot number.
- e. Code indicating bullet-resistant rating and test standard used.

2.13 FASTENERS

Fasteners exposed to view shall match in color and finish and shall harmonize with the material to which fasteners are applied. Fasteners shall be in accordance with Section 05500 MISCELLANEOUS METAL.

2.14 CORROSION PROTECTION - DISSIMILAR MATERIALS

Contact surfaces between dissimilar metals and aluminum surfaces in contact with concrete, masonry, pressure-treated wood or absorptive materials subject to wetting, shall be given a protective coating in accordance with Division 9 Section PAINTING.

2.15 SHOP/FACTORY FINISHING

All factory or manufactured components shall be shop finished as indicated below.

2.15.1 Ferrous Metal

Surfaces of ferrous metal, except galvanized and stainless steel surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating other than a bituminous protective coating, compatible with finish coats. Prior to shop painting, surfaces shall be cleaned with solvents to remove grease and oil, and with power wire-brushing or sandblasting to remove loose rust, loose mill scale and other foreign substances. Surfaces of items to be embedded in concrete shall not be shop painted.

2.15.2 Galvanizing

Items specified to be galvanized shall be hot-dip processed after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M or ASTM A 653/A 653M as applicable.

2.15.3 Aluminum

Unless otherwise specified, aluminum items shall be standard mill finish. Anodic coatings shall conform to paragraph FINISHES.

PART 3 EXECUTION

3.1 EXAMINATION

Existing work shall be examined to ensure that it is ready for installation or erection of the components. Components shall be checked and corrected for racking, twisting, and other malformation prior to installation. All surfaces and connections shall be examined for damage prior to installation. Examine all surfaces, depressions, utility rough-ins, embedded anchors, fixtures, and other features that may be present in the firing range areas prior to installation of the equipment. Coordinate depth of pit with requirements of bullet recovery tank manufacturer. Tank closure panel must be flush with adjacent floor.

3.2 PREPARATION AND PROTECTION

The Contractor shall field verify dimensions of rough openings for components, and shall verify that surfaces of openings are plumb, true, and provide required clearances. The Contractor shall protect surrounding work prior to installation of firing range equipment. Surrounding work which is damaged as a result of the installation of the equipment shall be restored to like-new condition prior to acceptance of the work described herein.

3.3 INSTALLATION

Comply with manufacturer's recommendations for the installation of equipment. Installation of the equipment under this section shall be by the manufacturer's crew of installers, or an installer approved in writing by the manufacturer. The finished work shall be rigid, neat in appearance and free from defects. Equipment shall be installed plumb and level, and secured rigidly in place. All other components shall be installed in accordance with approved manufacturer's recommended instructions. All operable parts of components shall be tested for smooth, trouble-free operation, in the presence of the Contracting Officer's representative.

3.4 FRAMED INSTRUCTIONS

Framed instructions, under glass or in plastic with all edges laminated, including wiring and control diagrams showing the complete layout of each item of equipment, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking for normal safe operation, and procedures for safely starting and stopping shall be prepared in typed form, framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing.

3.5 ADJUSTING/CLEANING

Adjustments shall be made to operating parts to assure smooth operation. Units shall be water and air tight when closed and locked. All components shall be cleaned in accordance with manufacturer's instructions.

3.6 FINAL INSPECTION

Following installation of equipment, all equipment shall be inspected by the manufacturer's quality control officer to certify that all factory quality control standards are met in the complete installation. The quality control officer shall instruct the Owner of all maintenance required for the range equipment.

-- End of Section --

SECTION 11600

LABORATORY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of laboratory equipment is shown on drawings and as specified herein. A portion of this work is furnished by the Owner. The responsibilities and duties of the Contractor are specified below. Laboratory equipment included in this specification include:
1. Single door, small vacuum sterilizers with isothermal capability.
 2. Single door, medium vacuum sterilizers with isothermal capability.
 3. Glassware washer/dryers and accessories.
 4. Biological safety cabinets.
 5. Horizontal laminar flow clean bench.
 6. Fume extractor arms.
 7. Ductless fume enclosures.
 8. Ventilated work station.
 9. Two-compartment stainless steel sink.
 10. Stainless steel sink, stand and shelf.
 11. Fiberglass sink, stand and shelf.
 12. Freestanding tall metal storage shelving.
 13. Freestanding flammable storage cabinets.
 14. Safety Shelving.
 15. Gas cylinder restraints.
 16. Spill deck.
 17. Roller table.
 18. Refrigerators and freezers.
 19. Evidence Storage Lockers.
 20. Polymer Shelving System.
- B. Related sections:
1. Division 5 Section "Miscellaneous Metal" for above ceiling steel supports for laboratory equipment.
 2. Division 6 Section "Rough Carpentry" for wood blocking to support laboratory equipment.
 3. Gypsum Board Assemblies: Division 9.
 4. Laboratory Fume Hoods: Division 11.
 5. Laboratory Casework: Division 12.
 6. Mechanical Work: Division 15.
 7. Plumbing Work: Division 15.
 8. Electrical Work: Division 16.

1.2 DEFINITIONS

- A. Broom Clean: A condition in an interior area in which surface debris has been removed by dry methods.

- B. Rough-In Point: Individual or common supply of mechanical, electrical, and heating, ventilating and air conditioning (HVAC) through wall, floor or ceiling.

1.3 PROJECT SITE CONDITIONS

- A. Site Access. Provide access for vehicle delivery. Keep receiving area and corridors clear of materials and work to allow access to installation areas.
- B. Building Finish. Prior to delivery of laboratory equipment, conduct a review of the facility to confirm that the following requirements are met. To ensure an orderly installation and to minimize damage to laboratory equipment, complete the listed final building systems:
 - 1. Environmental Conditions: Complete exterior envelope including roofing, wall systems, exterior glazing, joint sealers, doors, interior walls, finishes, HVAC, sprinkler, plumbing, electrical systems to protect equipment from the temperature, humidity, construction activity, elements and to provide security for stored equipment.
 - 2. No water intrusion or leaks are permitted. Complete all water and moisture producing operations such as masonry, terrazzo, plasterwork, allowing for drying and curing.
 - 3. Certify floor level tolerances as specified in Division 9, allowing an even surface for equipment installation. Install interior floor finish.
 - 4. Painted walls.
 - 5. Ceiling grid and panels.
 - 6. Branch electrical circuits and grounding conductors.
 - 7. Air conditioning system with diffusers.
 - 8. Sprinkler lines with heads.
 - 9. Lighting.
 - 10. Mechanical lines including tests for leaks.
 - 11. Cold weather: Provide temporary or permanent heat to maintain ambient room temperatures in a range of 13-20 degrees C.
 - 12. Power Requirements: Provide temporary or permanent electric power to rooms for laboratory equipment installations.
 - 13. Rough-in connections to laboratory equipment: Coordinated with the Approved Shop Drawings for service, size and locations, allowing for Final Hook-up and Connections.
 - 14. Test service lines (water, gas, vacuum, special gases, etc.) for leaks. Clean and cap for connection of service fittings.
 - 15. Rooms in which laboratory equipment is to be installed shall be broom clean.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver laboratory equipment only after wet operations in building are completed. The Contractor is required to schedule activities in such manner that the condition of the building does not delay the delivery and installation of laboratory equipment.

- B. For Government Furnished and Contractor Installed equipment (GFCI), delivery by the Owner shall be to a point on the site, outside the building agreed upon between the Owner and the Contractor. Representatives of the Owner will, in company of the Contractor, be present to inspect for the record any damage discovered during unloading. A list of all found damage or known hidden damage shall be kept for all government furnished equipment to determine condition of equipment on receipt by Contractor.
 - C. Installation drawings: Shall be provided by the supplier to the Contractor showing installation requirements for equipment.
 - D. The Contractor shall coordinate the installation of the equipment noted as GFCI as follows:
 - 1. The Contractor shall notify the Owner 30 days prior to the time installation roughing in needs to begin on the equipment.
 - 2. The Contractor shall notify the Owner when roughing in is finished and the area is ready to receive equipment.
 - 3. The Contractor shall coordinate with all trades all installation requirements of the equipment.
 - E. The following Contractor responsibilities are included in this contract for GFCI equipment:
 - 1. Receive new equipment.
 - 2. Unload equipment.
 - 3. Distribute equipment to installation location.
 - 4. Uncrate equipment.
 - 5. Clean up and dispose of rubbish associated with installation.
 - 6. Place in position and install the equipment.
 - 7. Clean up.
 - 8. Protect all equipment.
 - F. Laboratory equipment shall be stored in a ventilated place, protected from the weather, with relative humidity therein of 50 percent or less at 21 degrees C.
 - G. The Contractor shall protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.
- 1.5 CONTINUITY AND COOPERATION WITH OTHER TRADES
- A. The Contractor is responsible for coordination of Work and to ensure continuity, cooperation for the installation of laboratory equipment. Upon receipt of Approved equipment installation drawings that are signed and dated by the Reviewer, the Contractor may proceed with rough-in utilities.
 - B. The Contractor is responsible for protecting laboratory equipment from damage by his subcontractor trades.
 - C. Painting and Other Finishing: Do not use installed equipment or casework as a work surface or workbench. Perform minor wall touch-up

around laboratory equipment and caulk between laboratory equipment and walls. Protect installed laboratory equipment, especially the laboratory work surface, from debris, paint and damage in the course of the construction sequence.

1.6 SUBMITTALS

- A. Submit the following in accordance with Section 01330 "Submittal Procedures" for each item listed in Article 1.1.
- B. SD-02 Shop drawings:
 - 1. Laboratory equipment and schedules; G A/E.
 - 2. Shop drawings shall indicate utilities required.
 - 3. The Contractor may proceed with rough-in utilities upon receipt of approved equipment installation drawings that are signed and dated by the Reviewer.
- C. SD-03 Product Data:
 - 1. Laboratory equipment; G A/E.
 - 2. Provide names of service organizations associated with products.
- D. SD-04 Color samples: Submit manufacturer's standard color samples for Architect's selection.
- E. SD-06 Test Reports:
 - 1. Laboratory equipment; G A/E.
- F. SD-08 Manufacturer's Instructions:
 - 1. Laboratory equipment; G A/E.
- G. SD-10 Operation and Maintenance Data:
 - 1. Laboratory equipment; G A/E.
 - 2. Submit operation and maintenance data in accordance with Division 1 Section "Operation and Maintenance Data."

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer shall provide a list of five reference units configured with both a vacuum and isothermal configuration. Manufacturers unable to provide such a list are unacceptable.

2.2 STERILIZERS

- A. Single door, small vacuum sterilizer with isothermal capability.

1. Nominal size: 508 x 508 x 965 mm.
 2. Steam Supply: Pipe, valve, trap and regulate sterilizer for operation on internal electric steam generator. Include steam strainer, hand valve shutoff and internal pressure regulator.
 3. Pressure Vessel: Design chamber and jacket to withstand 345 kPa with simultaneous full vacuum in chamber.
- B. Single door, medium vacuum sterilizer with isothermal capability.
1. Nominal size: 610 x 914 x 1219 mm.
 2. Steam Supply: Valve, trap and regulate sterilizer for operation on steam delivered at 345-550 kPa from stand-alone steam generator. Include steam strainer, hand valve shutoff and internal pressure regulator.
 3. Electric Steam Generator:
 - a. Generator Rating: 30 kW; 480 V, 3 Phase.
 - b. Construction: Carbon Steel.
 - c. Fully insulated boiler.
 4. Pressure Vessel: Design chamber and jacket to withstand 275 kPa with simultaneous full vacuum in chamber.
 5. Double door mounting, recessed through two walls where indicated on the drawings.
- C. Sterilizer Features:
1. Provide microcomputer monitor and control system with vacuum fluorescent display (status, time of day, cycle times, temperature and pressure and any warnings or instructional messages) and integral thermal printer mounted on vertical column located on opposite side of door hinge. Units with microcomputer controls, operator interfacing, or critical components directly above the chamber in the path of rising steam are not acceptable. Microcomputer will indicate alarms via two line fluorescent display and printed alarm condition. Alarms should be noted as complete messages without cross interference codes. Microcomputer will have an auto utilities start up and shut down feature in the interest of saving utility cost and ensuring a charged jacket upon user arrival. Provide timers to automatically reset at end of cycle and if temperature drops 1.1 degree C below operator established set point during exposure.
 2. Provide gravity, pre-vacuum, express and isothermal capability.
 3. Manual Control: Furnish a single programming wheel and a functional controller. Design to operate gravity and liquid cycles without electric power.
 4. Provide one-piece model door frame. Bearing mount doors to frame using stainless steel hinges. Equip door for manual opening and closing. Door is a vertical sliding type.
 5. Cabinet enclosed, freestanding unit.
 6. Support sterilizer on steel stand, coated for corrosion protection.
 7. Internal chamber steam baffling shall be provided to minimize direct impingement on the load, and to ensure proper steam distribution in the chamber.

8. Safety valve: ASME approved and so stamped, for jacket and chamber, set and sealed at the approved maximum operating pressure of the vessel. Sealed valve so that setting cannot be altered, and will blow down at least 2 psig before closing. Valve is set so that pressure in the vessel will not rise above 10 percent over the set pressure.
9. Drain discharge cool down.
10. Standard service response of 24 hours. List name of service personnel as part of submittal.

D. Standards

1. Federal Specification GG-S-1340A.
2. Federal Specification GG-S-1343A.
3. Underwriters Laboratory (UL).
4. ASME Code, Section VIII, Division 1.
5. ASTM Specification A240.
6. ASTM Specification B88.
7. ASTM Specification B43 or B135.
8. Canadian Standards Association (CSA).

E. Accessories: (Per sterilizer)

1. Tray hooks, quantity 2 (two).
2. Rack with 2 (two) shelves, quantity 1 (one).
3. Automatic Controls, including flush system, water level control, steam pressure controls, electric door interlock, auxiliary low water cut-off, and water sensing system

2.3 LABORATORY GLASSWARE WASHER/DRYER

- A. Unit to be cabinet style model with vertically sliding door with tempered glass to allow visual confirmation of the washing process.

B. Features:

1. Provide microcomputer monitor and control system with vacuum fluorescent display and integral thermal printer. Pre-programmed adjustable light, medium and heavy cycles plus seven customizable cycles. Capable of up to twelve, pre-programmable cycles including a de-scaling cycle and a detergent prime cycle
2. Cabinet: All components of the wash and rinse system are composed of 304 stainless steel with #4 finish, including the screens, rotary spray arm, pump, and piping. Units with nylon pumps are unacceptable. Units must be completely welded with no bolt and screw fabrication acceptable.
3. Chamber Load Capacity: 660 x 635 x 660 mm.
4. 7-1/2 HP dual-speed pump.
5. Manifold washing and drying system. Water and detergent is directed through each spindle and inside each individual piece of glassware, as well as rotary spray arms washing the outside of the items. Hot air is directed through the spindles and into each individual piece of glassware, as well as recirculated throughout the chamber to ensure efficient drying. Units without a manifold drying feature are unacceptable. Unit will provide for

at least three levels of manifolds, with a total of six manifolds to be utilized at one time; two on each level.

6. Pure water rinse tank.
7. Double-tempered glass, manually operated, vertical sliding door.
8. Interior light.
9. Provide unit with two automatic detergent pumps, peristaltic type, with a low level alarm noted on microcomputer as a fluorescent display without cross-reference codes.
10. Drain discharge cool down.
11. Preheated Wash and Rinse Water (Water Temperature Booster): Provide cycle that electrically preheats water to 82 degrees C for WASH and RINSE phases. Design controls so that feature may be bypassed using cycle temperature selector.

C. Cycles: Provide the following cycle phases:

1. Pre-wash: Chamber fills with cold tap water to pre-set level. Wash load for 1 minute or time interval selected (0 to 15 minutes), and drain chamber.
2. Wash: Wash load with 82 degree C detergent water for 4 minutes or time interval (0 to 15 minutes) selected. Drain chamber.
3. First Rinse: Rinse load with programmable recirculated hot water or optional 82 degree C heated water for 1 minute or time interval (0 to 15 minutes) selected. Drain chamber.
4. Thermal Rinse: Rinse load with recirculated 82 degree C heated water for 1 minute or time interval (0 to 10 minutes) selected. Drain chamber.
5. Pure Water Rinse: Provide cycle that rinses with a measured amount of pure, non-recirculated, water for 10 seconds. Design controls so that feature may be bypassed.
6. Drying Treatment: Chamber air is heated to the selected temperature 66 - 116 degree C, and recirculated through the chamber and accessory headers for a selected amount of time (0 to 30 minutes). Minimum 1 1/3 HP blower.

D. Accessories:

1. Barrier wall flange assembly.
2. Transfer cart capable of marrying up with the washer and manifolds to slide from the chamber directly onto the transfer cart
3. General-purpose basket.
4. Bottom rotary spray arm.
5. 8-spindle manifold with supports.
6. 18-spindle manifold with supports.
7. 32-spindle manifold with supports.
8. Adjustable accessory loading shelf.

2.4 BIOLOGICAL SAFETY CABINETS

- A. Biological safety cabinet designed for sterile product preparation and biological experimentation involving agents of low and moderate risk.
- B. Unit: Class II, Type A2 (Formerly designated Class II, Type B3 per NSF 49-1992).

1. Interior Dimensions:

- a. Width: 1150 mm and 1750 mm.
- b. Depth: 550 mm.
- c. Height: 690 mm.

C. Features:

1. Work surface and sidewalls of type 304 stainless steel, 16 gauge, and one-piece construction with radius corners. Cabinet constructed of 16-gauge cold-rolled steel with baked enamel finish. Provide sliding or hinged view screen with 6 mm safety glass.
2. Lower-front work area airfoil to improve access opening containment capability.
3. Stainless steel air diffuser and filter protector in work area.
4. Zero probed HEPA filter on supply and exhaust to be front loading. HEPA filters shall be rated for 99.99 percent efficient for 0.3-micron particulates by DOP test.
5. One manufacturer's sidewall-mounted standard petcocks with exterior connections through bottom of unit for connection to utilities from below. Provide NPT male connection with caps extending 100 mm minimum below underside of cabinet. Mount petcock on side of cabinet adjacent to casework or wall mounted petcocks. See drawings for locations.
6. Externally mounted fluorescent light fixture providing 1076 lux at work surface minimum.
7. Stainless steel ball valve drain.
8. Externally mounted switch for fan and light.
9. Telescoping adjustable legs with adjustable leg levelers.
10. Internal germicidal ultraviolet lamp.
11. One sidewall mounted GFIC protected duplex electrical receptacle.
12. Speed controller automatically compensates for voltage change to maintain constant voltage to motor.
13. A microprocessor controller with touch pad membrane control panel.

D. Airflow:

1. Calculated air intake velocity through front access opening at 200 mm operating level: 30 mpm, minimum.
2. Thimble Exhaust: The maximum airflow reading at the exhaust thimble shall not exceed the specified airflow, as scheduled on the Mechanical drawings.
3. Unit capable of automatically handling 80 percent minimum increase in filter loading and not decrease total air delivery more than 10 percent. With use of the speed controller, a 165 percent increase attainable.
4. Audible and visible alarm system to indicate low exhaust airflow.

E. Testing

1. Provide a certified copy from the manufacturer of the Personnel, Product and Cross-contamination (biological) tests, equivalent to or more severe than as specified in NSF/ANSI Standard #49-2002,

performed on one (1) unit from each production run from which cabinets purchased have been manufactured.

2. Before shipping, conduct a complete test on each unit to assure cabinet meets Class II requirements. Provide a copy of this test with the unit.
3. Certify installation (in situ testing) by independent testing agency approved by the Owner but paid for by the Contractor.

F. Warranty:

1. Provide manufacturer's 36-month warranty against defects in materials and workmanship.

2.5 HORIZONTAL LAMINAR FLOW CLEAN BENCH

A. A horizontal laminar flow clean bench, which provides a HEPA, filtered airflow across the work area, and a particulate-free work surface.

B. Unit: Class 100 cleanliness.

1. Interior Dimensions: 1750 mm wide x 700 mm high.

C. Features:

1. Work surface and sidewalls of type 304 stainless steel with #4 finish, 16 gauge, and one-piece construction with radius corners. Cabinet constructed of 18-gauge cold-rolled steel with white baked enamel finish.
2. Hinged acrylic face shield.
3. Stainless steel air diffuser and filter protector in work area.
4. Zone cabinet downflow velocity profile, i.e., a higher velocity of downflow behind the view screen, relative to downflow velocity over the work surface.
5. All contaminated ducts plenums and work area sidewalls of stainless steel construction and maintained under negative pressure.
6. Zero probed HEPA filter on supply and exhaust to be front loading.
7. High velocity return air slots located along the front edge and sidewalls of the work area.
8. Two manufacturer's sidewall-mounted standard petcocks with exterior connections through bottom of unit for connection to utilities from below. Provide NPT male connections with caps extending 100 mm minimum below underside of cabinet. Mount petcocks on side of cabinet adjacent.
9. Recessed mounted fluorescent light fixture providing 2150 lux at work surface minimum.
10. Externally mounted switch for fan and light
11. Exterior mounted GFIC protected duplex electrical receptacle.
12. Speed controller automatically compensates for voltage change to maintain constant voltage to motor.
13. Adjustable leg risers for work surface heights between 900-950 mm.

D. Airflow:

1. Calculated air intake velocity through front access opening at 30 mpm, average.
2. Unit capable of automatically handling 80 percent minimum increase in filter loading and not decrease total air delivery more than 10 percent. With use of the speed controller, a 165 percent increase attainable.
3. Audible and visible alarm system to indicate low exhaust airflow.

E. Testing:

1. Provide a certified copy from the manufacturer of the Personnel, Product and Cross-contamination tests, equivalent to or more severe than as specified in IES-RP-CC-002-86, performed on one (1) unit from each production run from which cabinets purchased have been manufactured.
2. Before shipping, conduct a complete test to assure cabinet meets Class 100 requirements. Provide a copy of this test with the unit.
3. Certify installation (in situ testing) by independent testing agency approved by the Owner but paid for by the Contractor.

F. Warranty:

1. Provide manufacturer's 36-month warranty against defects in materials and workmanship.

2.6 FUME EXTRACTION ARMS (TASK EXHAUSTS)

- A. Provide a jointed, articulating fume extractor arms for mounting on the wall, ceiling, or bench top as indicated on the drawings. Fume extractors designed to handle smoke, dust, chemicals, solvents, and fumes.
- B. Unit: Flexible Mini Arms with 250 mm diameter metallic hood, and no light. Provide wall, ceiling, and bench brackets as required.
 1. Finish: White polypropylene with aluminum sections.
 2. Hood: Powder coated aluminum.
- C. Features:
 1. 75 mm diameter constructed of aluminum sections, and joints comprised of polypropylene. Extraction arms will be connected to the building exhaust system by metal ductwork.
 2. Arms shall have a minimum 180-degree turning radius and minimum reach of 1300 mm.
 3. Arms shall consist of one short segment for connection to duct, two intermediate segments, and one short segment for hood attachment, and large, knurled ball bearing adjustment joints.
 4. Arms designed to remain in set position without horizontal or vertical drifting.

2.7 DUCTLESS FUME ENCLOSURE

- A. Ductless fume enclosure designed for forensic applications such as print fuming, analysis of fingerprints and gunshot patterns, weighing dangerous powders, and drug identification.
- B. Basis of Design Unit is Model AU-550E Aura Ductless Fume Enclosure by Misonix Incorporated.
- C. Unit features:
 - 1. Internal pre-filter change.
 - 2. Safety filter.
 - 3. Advanced monitoring system consisting of digital display of airflow.
 - 4. Audible and visual warning alarms.
 - 5. Sloping front.
 - 6. Meet OSHA and ANSI Z9.5 standards.
- D. Performance requirements:
 - 1. Volume treated air: 7.65 cubic meters/minute.
 - 2. Average face velocity: 0.63 m/s.
 - 3. Filter: Rated at 0.5 microns.
 - 4. Electrical: 110V/60Hz.
- E. Unit Dimensions: 1050 mm wide x 700 mm deep x 785 mm high.
- F. Unit Construction:
 - 1. Head Section: Aluminum.
 - 2. Base Section: Steel with 6 mm white acrylic.
 - 3. Finish: Powder coated, chemical resistant.
 - 4. Spill Tray: Fiberglass.

2.8 VENTILATED WORK STATION

- A. Portable Work Station designed for forensic applications such as slide staining and coverslipping, drug and chemical analysis, pipetting, graphic arts, and balances. Unit offers protection from exposure to chemical solutions and powders encountered when processing evidence for latent prints.
- B. Basis of Design Unit is Model FE-2620 Work Station by Misonix Incorporated.
- C. Unit features:
 - 1. Internal electrostatic pre-filter.
 - 2. Safety filter.
 - 3. Sloping front.
 - 4. Meet OSHA and ANSI Z9.5 standards.
- D. Performance requirements:
 - 1. Adjustable airflow: 0-130 fpm.
 - 2. Filter: Rated at 0.5 microns.

3. Electrical: 110V/60Hz.

E. Unit Dimensions: 650 mm wide x 400 mm deep x 732 mm high.

F. Unit Construction:

1. Head Section: Aluminum.
2. Base Section: Steel with 6 mm white acrylic.
3. Finish: Powder coated, chemical resistant.
4. Spill Tray: Fiberglass.

2.9 TWO-COMPARTMENT STAINLESS STEEL SINK

A. Compartments: 600 x 600 x 300 mm deep.

B. Provide with draining sideboards, size as shown on drawings.

C. Construction: 14-gauge type, 316 stainless steel, formed and seamless welded. Radius bend formations and 6 mm inside radius fillet welds at corners. Provide 6 mm raised front rim along sink and sideboards. Provide 300 mm high backsplash and sidesplash guards with 45 degree beveled top edge.

D. Legs: 16-gauge, 41 mm diameter stainless steel tube.

E. Provide with twist handle remote drains, stainless steel strainer, and tailpiece on all compartments.

2.10 STAINLESS STEEL AND FIBERGLASS SINKS, STAND AND SHELF

A. Sink Sizes: As indicated on the drawings.

B. Stainless Steel Sink Construction: 18-gauge type, 316LC stainless steel, formed and seamless welded, with 25 mm radius outside corners. Inside rounded corners, with 38 mm finished lip on all sides of sink. Integral 225 mm high by 125 mm wide backsplash panel. Provide alternate drain positions as indicated on the drawings.

C. Fiberglass Sink Construction: One-piece construction of polyester resin, and type E fiberglass, with rounded inside and outside corners. Gel coated gray finish. Molded raised duckboard bottom, with 38 mm diameter stainless steel drain in fixed location, as indicated on the drawings. Integral 175 mm high by 125 mm wide backsplash panel.

D. Stands: 18-gauge stainless steel construction, 950 mm high, with solid end panels with leveling feet. Top, rear, and rear horizontal panels. Full length and width below sink storage shelf, of stainless steel.

E. Fittings are specified in Section 12350 Laboratory Casework.

2.11 FREESTANDING TALL METAL STORAGE SHELVING

- A. Factory-formed, field-assembled, freestanding, post-and-shelf metal storage shelving system; designed for shelves to span between and be supported by corner posts, with shelves adjustable over the entire height of shelving unit. Fabricate initial shelving unit with a post at each corner. Fabricate additional shelving units similarly, so each unit is independent. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated.
- B. Modular assembly of 14 gauge steel uprights and 18-gauge reinforced adjustable metal shelves.
- C. Shelf Quantity: Three shelves per shelving unit including top and bottom shelf.
- D. Record Box Support Rails: 38-by-38-mm metal angle, with length to match depth of shelving unit; fabricated from same material and with same finish as beams.
- E. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - 2. Particleboard: ANSI A208.1, Grade M-2.
 - 3. Finish: Manufacturer's standard baked enamel.

2.12 FREESTANDING FLAMMABLE STORAGE CABINETS

- A. Construct cabinets to meet the Flammable and Combustible Liquids Code (NFPA 30) and OSHA specifications and be Factory Mutual approved.
- B. Size: Freestanding 1625 mm high x 850 mm wide x 850 mm deep, 227 liter capacity. Provide self-closing doors with fusible link.

2.13 SAFETY STORAGE SHELVING

- A. Modular assembly of 16 gauge steel uprights and 18-gauge reinforced adjustable metal shelves holding a maximum of 317 kg per shelf. Two-part epoxy finish painted in stock colors.
- B. Provide units that are 2100 mm high, 900 mm wide and 450 mm deep with six shelves per unit. Provide shelf guards for each shelf edge to provide continuous lip. Arrange units as shown on contract drawings and provide anchoring to wall or back to back for island configuration.

2.14 GAS CYLINDER RESTRAINTS

- A. Multiple racks, as indicated on the drawings, for the restraint and storage of gas cylinders. Frame of 50 mm x 50 mm x 3 mm thick tube steel and all joints welded smooth and polished. Anchor to building structure. Dual restraints of 8 mm steel welded link chain with snap hooks.

1. Quantity: As shown on drawings.

2.15 SPILL DECK

- A. Low profile polyethylene spill deck designed to contain spills from chemical containing drums.

1. Nominal Dimensions 4-Drum Unit: 1240 x 1240 x 625 mm.

2.16 ROLLER TABLE

- A. Gravity roller conveyor consisting of roller bed and conveyor support stands.

- B. Construction:

1. Frame: 88 mm deep by 38 mm flange by 10 gauge powder painted steel channel with bolt in cross members.
2. Rollers: 50 mm diameter by 16 gauge galvanized steel tubing, with grease packed bearings.
3. Floor supports: Permanent type, H-Style, standard duty spaced at 3 meters maximum.
4. Axles: 11 mm diameter hex shaft, spring loaded.
5. Capacity: 60 kg.
6. Finish: Manufacturer's standard paint.

- C. Unit Dimensions: 750 mm wide by 6 meters long.

2.17 REFRIGERATORS AND FREEZERS

- A. Where indicated, provide general purpose and explosion proof refrigerators and freezers of a commercial quality, intended for laboratory use.

- B. Undercounter Refrigerator:

1. Commercial UL and CUL listed.
2. Auto-defrost, with 2 wire shelves, and 3 in-door shelves.
3. Volume: 173 liter.
4. Exterior dimensions: 86 x 61 x 61 cm.
5. Adjustable thermostat, with temperature range of 1 to 7 degrees C.

- C. Explosion Proof Refrigerator for Flammable Material Storage:

1. Mechanical and compressor assemblies designed to prevent electrical sparks.
2. Listed by UL for Class 1, Group C and D applications.
3. Wiring complies with NEC, Article 501-4 for Class 1, Division 1 and 2.
4. Hardwired to appropriately rated conduit box.
5. In addition to the above requirements for hazardous locations, provide the following features:

6. Volume: 496 liters.
7. Exterior dimensions: 169 x 76 x 70 cm.
8. Temperature range: 0.8 to 9 degrees C.

D. Under Counter Freezer:

1. Commercial UL and CUL listed.
2. Manual-defrost, with one wire shelf, and 3 in-door shelves.
3. Volume: 173 liters.
4. Exterior dimensions: 86 x 61 x 61 cm.
5. Adjustable thermostat with temperature range of -12 to -7 degrees C.

2.18 EVIDENCE STORAGE LOCKERS

- A. Stainless steel hasp type storage lockers, multi-tier, including locker base, number insert, rubber door bumpers, and all necessary fillers and trim.

B. Construction:

1. Locker Material: Doors and frames of 16 gauge.
2. Shelves, sides, tops, and bottoms: 24 gauge.
3. Back: Perforated for ventilation and of 20 gauge.
4. Finish: Type 304 nickel bearing stainless steel, frame face #3 satin polish, and body #2 finish.
5. Doors decorator patterned.

- C. Fabrication: Frames formed and welded into integrated units with doors installed. Lock post closed at top and bottom. Top, bottom and sill cross members welded into frame uprights. Stainless steel locking hasp to be welded to the frame.

1. Body Parts: Formed shelves, tops, bottoms, and sides to be attached to frame assembly using corrosion resistant nuts and bolts and aluminum or stainless steel rivets.
2. Doors: Louverless, self-closing and flange formed on all sides. Each door to be equipped with a reinforcement welded into position. Stainless steel locking hasp welded to the door.
3. Locker Size: 305 mm wide x 321 mm high x 457 mm deep.

2.19 POLYMER SHELVING SYSTEM

- A. Reinforced polymer shelving system designed to snap easily into framework without the use of tools. Provide a lifetime warranty against rust and corrosion.

1. Solid shelves with molded in lip to contain spills. Provide textured top surface to keep products from sticking to the shelves. Provide 4 shelves, including top and bottom.

2. Numbered posts to allow quick and easy setup. Provide shelves that lock into posts with adjustments on 13 mm centers. Equip posts with leveling feet to accommodate irregular floor surfaces.
3. Unit Size: 1575 mm high x 450 mm x 1050 mm.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine surfaces designated to receive work for conditions that would adversely affect the finished work. Repair or replace surfaces not meeting tolerances or quality requirement governing substrate construction prior to start of work.

3.2 UTILITIES

- A. Inspect and verify that all necessary utilities have been roughed in prior to equipment installation.

3.3 INSTALLATION

- A. Install in strict accordance with manufacturer's printed instructions. Make all final utility connections, and test equipment to assure proper working order.
- B. Sterilizers and Glassware units shall be installed by a manufacturer trained and employed, locally based service technician. All units shall come with a two-year preventative maintenance agreement, to include all parts and labor, and to be performed by a locally based manufacturer trained and employed service technician.

3.4 CLEANING

- A. Prior to final acceptance, clean soiled surfaces and repair or replace items, which become damaged.

3.5 PROTECTION

- A. Protect materials and installed laboratory equipment from damage by work of other trades until final acceptance.

END OF SECTION 11600

SECTION 11610

LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Open By-pass Bench-top Fume Hoods.
 - 2. Snorkels
- B. Work described in this section includes the fabrication and installation of laboratory fume hoods, their related understructures, and accessory components coordinated with laboratory furniture and fixture systems specified in Division 12 Section "Laboratory Casework."
- C. The location and types of fume hoods are indicated on the drawings and scheduled on the Fume Hood Schedule.
- D. Base cabinets are specified in Division 12 Section "Laboratory Casework."
- E. Fume hood vent connection, from fume hood duct collar to building exhaust system, is the work of Division 15. Test and Balance of the HVAC system includes Fume Hoods and is included in Division 15. Installation and connection of all plumbing fixtures is the work of Division 15. Installation and connection of all controls is the work of Division 15.
- F. Laboratory fume hoods and related mechanical and electrical service fixtures are to be provided, internally pre-wired and pre-piped under this section. Connection to the building rough in is by Divisions 15 and 16. Electrical service fixtures shall be GFCI protected. The Contractor shall demonstrate each hood to properly function in accordance with the specifications.
- G. Related Sections include the following:
 - 1. Metal supports above ceiling: Division 5 Section "Miscellaneous Metal."
 - 2. Laboratory Casework and Fixtures: Division 12.
 - 3. Mechanical work: Division 15.
 - 4. Plumbing work: Division 15.
 - 5. Electrical: Division 16.

1.2 PERFORMANCE REQUIREMENTS

- A. Containment: Provide fume hoods with the following performance ratings at a face velocity of 0.51 m/s and a release rate of 4.0 L/min when tested according to ASHRAE 110.

- 1. As-Manufactured Rating: AM 0.05 ppm.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01330 "Submittal Procedures" for each item listed in Article 1.1.

- B. SD-02 Shop Drawings: For laboratory fume hoods, canopy hoods, and snorkels, include plans, elevations, sections, details, and attachments to other work.

- 1. Fume hoods, Snorkels, and Schedules; G, A/E.
 - 2. Indicate locations of blocking and other supports required for installing units.
 - 3. Indicate locations and types of service fittings, together with associated service connections required.
 - 4. Indicate plumbing connections, duct connections, electrical connections, and locations of access panels.
 - 5. Include roughing-in information for mechanical, plumbing, and electrical connections.
 - 6. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from above items.
 - 7. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
 - 8. Include coordinated dimensions for laboratory equipment specified in other Sections.

- C. SD-03 Product Data:

- 1. Fume hoods, snorkels; G, A/E.
 - 2. Provide names and service organizations associated with products.

- D. SD-04 Color samples: Submit manufacturer's standard color samples.

- 1. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for fume hood exterior, cabinets, and each type of top material indicated.
 - 2. Samples for Verification: 150 mm square samples for each type of finish, including top material.

- E. SD-06 Test Reports:

- 1. Fume hoods; G, A/E.
 - 2. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of fume hoods with requirements based on comprehensive testing of hoods.

- F. SD-08 Manufacturer's Instructions:

1. Fume hoods, snorkels; G, A/E.
2. Submit operation and maintenance data in accordance with Division 1 Section "Operation and Maintenance Data."
3. Operation Instruction: Submit 2 copies of operating and maintenance instructions for each fume hood, provided in booklet form providing information on adjustment, operation and maintenance of hood.

G. SD-10 Operation and Maintenance Data:

1. Fume hoods; G, A/E.
2. Submit operation and maintenance data in accordance with Division 1 Section "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain laboratory fume hoods through one source from a single manufacturer.
1. Obtain through the same source and from the same manufacturer as laboratory casework specified in Division 12 Section "Laboratory Casework."
- B. Fume Hood Designations: Drawings indicate sizes and types of fume hoods by referencing Fume Hood Schedule.
- C. General Performance: Design fume hoods so that, when connected to exhaust system that provides exhaust volume indicated on the drawings under normal laboratory conditions, fume hoods will operate in a safe, consistent, and efficient manner, within acceptable tolerances for face velocities specified. Dead air pockets and reverse air currents will not be permitted along surface of hood interiors. Negative variations of face velocity shall not exceed 20 percent of the average face velocity.
- D. Static Pressure Loss: Fume hoods shall be designed to minimize static pressure loss. With sash at 450 mm open position, static pressure loss through the fume hood shall be no more than 7 mm of water gauge when the hood operates at a face velocity of .51m/s. The manufacturer shall state the design static pressure loss in his submittal. For all laboratory fume hoods equipped with a bypass, static pressure loss and exhaust volume shall be relatively constant regardless of sash position.
- E. Source Quality Control: The Architect reserves the right to require the manufacturer to demonstrate hood performance and submit testing results verified by an independent engineering testing laboratory prior to shipment to prove compliance with contract requirements. Test hoods, testing facility, instrumentation, apparatus and equipment shall be supplied by manufacturer at no cost to Owner. Test hoods to verify performance requirements in accordance with Section 6 of Scientific Apparatus Makers Association Standard LF-10-1980. Failure to meet the performance requirements shall be cause for rejection.

- F. Chemical and Physical Resistance of Fume Hood Finish: Shall meet SEFA 8 1999 standards. See Division 12 Section "Laboratory Casework", Part 1.
- G. UL 1805 Specification: All Fume Hoods must be Underwriters Laboratories subject 1805 classified. The 1805 standard covers electrical and mechanical hazards, investigates the flammability of materials and measures the effectiveness of airflow characteristics. Proper labeling must be affixed to the face of each fume hood indicating classification to the UL 1805 standard for Laboratory Fume Hoods. UL listing covering electrical components only or other listings that do not encompass all issues covered in UL 1805 is insufficient. All factory testing shall be performed in a U.L. certified test facility.

1.5 PRODUCT HANDLING

- A. Coordinate delivery of fume hoods with delivery of other laboratory casework components. Comply with the requirements of Division 12 Section "Laboratory Casework."
- B. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.6 COORDINATION

- A. It shall be the responsibility of the Contractor and the casework contractor jointly and mutually to coordinate with other trades to insure continuity and cooperation. Fume Hoods and casework, as installed, are considered to be finished equipment and shall be protected from damage by all trades.
- B. Mechanical and Electrical Trades: Where access is required through items of laboratory casework or fume hoods, it shall be the service trades' responsibility to remove said access panels, drawers, etc., where they occur, make their connections and properly replace such access panels, drawers at their own expense. The casework contractor and the mechanical, electrical trades shall cooperate in order to maintain job continuity.
- C. Painting and other Finishing Trades. At no time shall tradesmen use the installed work surface as a workbench. It is the responsibility of the Contractor to perform minor wall touch-up around fume hoods and to caulk between trim and wall as indicated on drawings. The Contractor shall adequately protect installed laboratory fume hoods and equipment, especially the laboratory work surface, from debris, paint, and damage in the course of the construction sequence.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet: Commercial-quality, cold-rolled, carbon-steel sheet, complying with ASTM A 366; matte finish; suitable for exposed applications; and stretcher leveled or roller leveled to stretcher-leveled flatness.
 - B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher leveled, No. 4 finish.
 - C. Chemical Fume hood liner: Reinforced polyester panel; smooth finish and white in color in final appearance. Flexural strength: 98 MPa. Flame spread: 15 or less per U.L. 723 and ASTM E84. Baffle same material as liner. Metallic baffles, brackets or supports on hood interior are not acceptable.
 - D. Hydrofluoric Fume hood liner: 6 mm thick white PVC or polypropylene.
 - E. Cast Epoxy Resin: Factory-molded, modified, epoxy-resin formulation, 32 mm thick and dished a minimum of 10 mm. Uniform mixtures throughout with smooth, non-specular finish. Color to be non-glaring black as specified for epoxy tops in the Laboratory Casework Section.
 - 1. Physical Properties: Comply with requirements of Division 12 Section "Laboratory Casework."
 - 2. Chemical Resistance: Comply with requirements of Division 12 Section "Laboratory Casework."
 - F. Laminated Safety Glass: ASTM C 1172, Kind LT; Condition A, Type I, Class I, Quality q3 lites with clear, polyvinyl butyral interlay.
 - G. Polycarbonate Glazing: Clear, uncoated polycarbonate sheet manufactured by extrusion process and complying with the following requirements:
 - 1. Impact Resistance: 640 to 850 J/m per ASTM D 256, Method A.
 - 2. Elongation and Modulus of Elasticity: 110 percent maximum and 2345 MPa, respectively, per ASTM D 638.
 - 3. Heat Deflection: 132 deg C at 1820 kPa per ASTM D 638.
 - 4. Flame-Spread Index: 25 or less per ASTM E 84.
 - H. Sash chain: ANSI #35 steel, single strand. Average tensile strength of 1088 kg, maximum working load of 217kg.
 - I. Sash guides: Extruded PVC.
 - J. Pulley assembly for sash chain: Finish bored steel drive sprockets and keyed drive, 13 mm diameter front connector shaft. Rear idler sprockets; double sealed ball bearings type, lubricated. All sprockets steel with zinc dichromate finish.
- 2.2 OPEN BY-PASS BENCH-TOP FUME HOODS
- A. Provide fume hoods with partial compensating bypass above sash, which opens after sash is closed to less than 40 percent open. Design partial bypass to maintain sufficient exhaust air volume through hood to adequately dilute hazardous fumes, regardless of sash position.

Provide hoods designed to operate with a face velocity of 0.51 m/s with sash opened at 450 mm high.

- B. Variable Air Volume Control: Hoods shall be equipped with two-position sash sensor switch located above the vertical rising sash and in the bypass air stream. Switch will be wired to air control valve under Division 15. The system will be designed to provide 0.51 m/s at vertical sash open to the 450 mm sash stop, and a set back mode of 0.51 m/s through the smaller horizontal sash opening.
- C. Splay top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
- D. Bottom horizontal foil by-pass will be flush with the work surface and shall provide clearance to pass through a 38 mm diameter hospital grade plug. Airfoil sills that are not flush with the top plane of the work surface are not acceptable.
- E. Vertical Rising Fume Hood Sash on 1200 mm units: Full view type with clear, unobstructed, side to side view of fume hood interior and service fixture connections. Sash to have a 900 mm sight line and a 720 mm vertical access height.
 - 1. Bottom sash rail: 51 mm maximum, 18-gauge steel with powder coat finish. Provide integral formed, flush pull the full width of bottom rail.
 - 2. Set safety glass into rails in deep form, extruded polyvinyl chloride glazing channels.
 - 3. Sash shall be designed to promote usage as an upper body and face shield. Face velocities and volumes shall be based on a 457 mm operating opening. Sash shall have the capability to be raised to full 720 mm vertical opening for loading or unloading of large apparatus. A lock open feature shall be provided. Sash shall lower automatically to the operating position when released from any position above 457 mm.
 - 4. Counter balance system: Single weight, sprocket and chain, counter balance system which prevents sash tilting and permits one finger operation at any point along full width pull. Maximum 3 kg pull required to raise or lower sash throughout the length of travel. Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure. Life cycle test 45 kg sash and weight to 100,000 cycles without sign of failure. Provide independent test data.
- F. Combination Vertical and Horizontal sash on 1800 mm units: Sash shall be top hung on nylon tired stainless steel ball bearing wheels providing a 900 mm sight line. Sash frame on bottom and sides must be no more than 40 mm thick and radiused to minimize turbulence. Area above the 700 mm vertical sash opening shall be glazed with a minimum of 10 mm thick laminated safety glass. All glass to have polished exposed edge treatment. Horizontal panels provided with finger pulls. Counter balanced system. Single weight, chain and sprocket same as vertical sash on 1200 mm fume hoods. A simple on/off type contact switch shall be provided above the vertical rising sash. Division 15 shall provide wiring to air valves.

- G. Baffles: Baffles shall incorporate exhaust slots located to purge the upper and lower area of the hood. Baffle to be non-adjustable. The minimum interior depth workspace at the extreme upper portion of the fume hood shall be 480 mm.
- H. Fume Hood Depth: Provide fume hoods with a minimum depth of 900 mm exterior dimension and 700 mm interior depth at work surface.
- I. Downdraft bypass: Low resistant type, 18-gauge steel chamber. Directional louvers are not acceptable. All bypass air shall enter top of bypass chamber and enter hood in a down flow direction.

2.3 FABRICATION

- A. Steel Exterior: Fabricate from steel sheet, 1 mm thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil, and to allow access to plumbing lines and service fittings. Electrostatically apply urethane powder coat selected from manufacturer's standard color offering to all interior and exterior surface of component parts and bake in controlled high temperature oven to assure a smooth, hard satin finish before final assembly. Surfaces shall have a chemical resistant, high-grade laboratory furniture quality finish. Comply with Division 12 Section "Laboratory Casework" for chemical and physical resistance criteria of finish.
- B. Ends: Double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.
- C. Interior Lining: Unless otherwise indicated, provide fume hoods with linings of the following material, except horizontal surfaces, shall be tops as specified in Section 12 "Laboratory Casework." Provide interior lining materials as follows:
 - 1. Material: Nominal 5mm thick reinforced polyester panel; smooth finish and white color in final appearance. Flexural strength: 98 MPa. Flame spread: 15 or less per UL 723 and ASTM E84.
 - 2. Provide PVC or polypropylene where scheduled.
- D. Lining Assembly: Fasten interior liner panels with non-metallic fasteners and provide gasketed interior access panels.
 - 1. Seal joints with chemical-resistant sealant before assembly to prevent open joints or spaces.
- E. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining.
 - 1. Provide 18 gauge, rectangular or round, powder coated steel duct stub for exhaust connection. Extend 76 mm above the top of the hood.
- F. Lights: Provide a vapor proof, 2-tube, rapid-start, fluorescent light fixture, of longest practicable length, complete with tubes at each

fume hood. Shield tubes from hood interior by 6mm thick laminated glass or 3-mm-thick tempered glass, sealed into hood with chemical-resistant rubber gaskets. Set units so fluorescent tubes are easily replaceable from outside of hood.

1. Provide fluorescent tubes with a color temperature of 3500 K and a minimum color-rendering index of 85.
 2. Provide two classified explosion-proof, 150 watt light fixtures approved for Class I, Division 2 locations where indicated on contract drawings.
- G. Sash Limits: Provide sash stop set to limit vertical sash height to 450 mm. Provide a label on fume hood at this point and a sign to read: "100 fpm - do not work in hood with sash bottom above this mark."
- H. Base Cabinets: Comply with requirements of Division 12 Section "Laboratory Casework."
- I. Mechanical Service Fixtures: Comply with requirements of Division 12 Section "Laboratory Casework."
- J. Countertops and Cup Sinks: Provide epoxy resin tops and cup sinks as indicated on Contract Drawings. Comply with requirements of Division 12 Section "Laboratory Casework."
- K. Filler Strips: Wood or metal, as applicable to match adjoining surfaces. Provide as necessary to close openings between fume hood base cabinet or hood exterior and adjacent building construction.
- L. Fume Hood Ceiling Enclosure: Provide manufacturers standard painted metal enclosure. Paint to match fume hood color. Top of enclosure to extend 15 mm above ceiling.
- M. Holes: Provide holes for passage of piping and conduit and for fixtures furnished under Division 12 Section "Laboratory Casework."
- N. Fasteners: Sheet metal screws, zinc plated for exterior structural member attachment. Interior fastening devices shall be concealed. Exterior panel member fastening devices shall be concealed. Exposed screws are not acceptable.

2.4 ACCESSORIES

- A. Signs shall be provided as follows:
1. Permanent 100 x 150 mm corrosion resistant plate attached to the fume hood exterior shall have condensed information covering recommended locations for apparatus, accessories, baffle settings, use of sash, and recommended safe operating procedures.
 2. Permanent 100 x 150 mm corrosion resistant metal or plastic frame attached to front face of hood exterior with plastic or glass cover to contain a removable data card, to identify hood and show hood characteristics and field tested data.

- B. Face Velocity Labels: Provide peel and stick type, fume and reagent resistant plastic labels for mounting on left or right hand of fume hood post. Labels to be applied after fume hood test and balance of system by Division 15.
- C. Sash Stop Decal: Provide safety decals mounted at strategic locations on the face of the fume hood to warn of operational safety precautions.

2.5 SNORKELS

- A. AA Type Snorkels: Where shown provide complete snorkel assembly with cone and clamping rings, support arm, mounting bracket and flexible duct.
 - 1. Cone shall be 300 mm diameter at mouth, 18 gauge, and Type 304 stainless steel unless otherwise noted and shall be complete with clamping collar.
 - 2. Stainless steel support arm, rod and brackets shall be 18 gauge, Type 304 stainless steel, adjustable in all four dimensions.
 - 3. Flexible duct shall be exhaust hose for use in high temperature exhaust applications. Flexible duct shall have aluminum finish to match connecting collar to the cone.
- B. Fume Extractor Arms are specified in Division 11 Section "Laboratory Equipment."

2.6 SAFETY DEVICES

- A. Provide safety alarm for each fume hood as specified under this Section.
- B. Safety Monitor/Alarm System: Provide device that monitors face velocity and provides audible and visual alarm if face velocity drops below safe levels. Unit design is based on thermally compensated thermistor in the alarm module. As the internal fume hood pressure changes, due to opening and closing of sash, the flow passing over the thermistor is calibrated to a face velocity, which is displayed on the front of the monitor.
 - 1. Safety monitor is UL listed, tamper proof, with all alarm circuits, electric components, external tubing, and manifolds furnished complete and factory installed on the fume hoods. The monitor shall have light emitting diode display, which provides clear indication of airflow conditions.
 - 2. Calibration is the responsibility of the Owner, and is required once the hoods are stationed and the hood exhaust and room supply systems are balanced. A secondary calibration has been factory set into the alarm's memory to determine that the alarm is functional and ready for shipment. The final calibration must be completed in the field.
 - 3. Airflow Sensor: Thermally compensated glass-beaded thermistor, factory connected to a sidewall port on the interior of the fume hood.

4. Alarm Signal: Audible signal and a visual, red large light emitting diode:
 - a. Silence pushbutton, which disables the audible alarm, shall be accessible on the front of the safety monitor.
 - b. Provide alternate mode in which audible alarm is silenced indefinitely but visual alarm remains activated until the alarm condition is corrected.
 - c. When alarm condition is corrected and face velocity and volume return to specified levels, the monitor automatically resets and begins routine monitoring of the airflow.
5. Provide test circuit to verify proper safety monitor operation.
6. Monitor shall indicate when sash is in the set-up position.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install fume hoods according to Shop Drawings and manufacturer's written instructions and local code requirements.
- B. Install plumb, level, aligned, and securely anchored to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where hoods abut finished work, apply filler strips and scribe for accurate fit with fasteners concealed where practical.
- C. Install safety monitor on face of hood at the factory.

3.2 FIELD QUALITY CONTROL

- A. Field test each unit after completion of installation to verify operation of hoods in accordance with requirements specified herein.
 1. Field Testing Requirements: Comply with requirements of SEFA LF-1-1991:
 - a. Perform tests in field to verify proper operation of the fume hoods before they are put in use using qualified personnel.
 - b. Perform tests after installation has been completed, the building ventilation system has been balanced, connections have been made, and written verification has been submitted that the above conditions have been met.
 - c. Verify that the building make-up air system is in operation, the doors and windows are in the normal operating position, and that other hoods and exhaust devices are operating at design conditions.
 - d. Correct unsafe conditions disclosed by these tests before request of test procedures.
 - e. Test Reports: Provide the Architect and Owner with a record of all tests.

2. Testing equipment:

- a. Properly calibrated hot wire thermal anemometer equal to Alnor Model No. 8500D-1 Compuflow.
- b. Supply of 30-second smoke bombs.
- c. Supply of titanium tetrachloride.

3. Test procedure - SEFA LF-1-1991:

- a. Check room conditions in front of fume hood using a thermal anemometer and a smoke source to verify that the velocity of cross drafts does not exceed 20% of the specified average fume hood face velocity. Eliminate any cross drafts that exceed these values before proceeding.
 - 1) CAUTION: Titanium tetrachloride fumes are toxic and corrosive. Use sparingly; avoid inhalation and exposure to body, clothing and equipment that might be affected by corrosive fumes.
 - 2) NOTE: No fume hood can operate properly if excessive cross drafts are present.
4. Perform the following test to verify conformance of actual fume hood face velocities to those specified. Turn on the exhaust blower with the sash in full open position. Determine the face velocity by averaging the velocity of six readings taken at the fume hood face, at the centers of a grid made up of three sections of equal area across the top half of the fume hood face and three sections of equal area across the bottom half of the fume hood face.
5. If not in accordance with specifications, refer to manufacturer's Troubleshooting Guide for aid in determining cause of variation in airflow.
6. Check sash operation by moving sash through its full travel. Verify that sash operation is smooth and easy, and that vertical rising sash shall hold at any height without creeping up or down.

B. Field testing of air flow in fume hoods without auxiliary air:

1. Turn fume hood exhaust blower on. With sash in the open position check airflow into the fume hood using a cotton swab dipped in titanium tetrachloride or other smoke source. Verify that airflow is into the fume hood over the entire face area by a complete traverse of the fume hood 150 mm inside the face. Reverse flow is evidence of unsafe conditions. Take necessary corrective actions and retest.
2. Move a lighted smoke bomb throughout the fume hood work area directing smoke across the work surface and against the sidewalls and baffle. Verify that smoke is contained within the fume hood and rapidly exhausted.
3. Test on fume hood of each type specified in accordance with the method prescribed in ASHRAE Standard ANSI/ASHRAE 110-1995. An "as manufactured" certified test report on the specific size, configuration and face velocity will be included with each hood that is shipped and provide copies for Architect and Owner.

4. Hood test shall take place in the facility with testing personnel, samples, apparatus, instruments, and test materials supplied by the manufacturer or independent testing agency.

3.3 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. Repair to new or remove and replace defective work as acceptable to Architect.
- C. Clean finished surfaces, including both sides of glass; touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.4 PROTECTION OF FINISHED WORK

- A. Protect materials and completed work from damage by work of other trades until final acceptance.

END OF SECTION 11610

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DIVISION 12 - FURNISHINGS

SECTION 12320A

CABINETS AND COUNTERTOPS

05/98

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SECTION 12320A

CABINETS AND COUNTERTOPS

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z124.3 (1995) American National Standard for Plastic Lavatories.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 570 (1995) Water Absorption of Plastics

ASTM D 638 (1997) Tensile Properties of Plastics

ASTM D 2583 (1995) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor

ASTM E 84 (1997a) Surface Burning Characteristics of Building Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9 (1994) Cabinet Hardware

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA ANSI/KCMA A161.1 (1995) Performance & Construction Standards for Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1995) High-Pressure Decorative Laminates

1.2 DESIGN

This Specification includes work in the Break Room, Employee Lounge and Office areas. Laboratory Casework is specified in Section 12350. Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Cabinets shall be constructed as specified and shall meet the requirements of KCMA ANSI/KCMA A161.1. Wall and base cabinet assemblies shall consist of individual units joined into continuous sections. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Counters shall be provided with watertight sink rim when indicated. Drawers shall be removable and shall be equipped with position stops to

avoid accidental complete withdrawals. Shelves shall be fixed or adjustable as indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G A/E

Drawings showing each type of cabinet and related item, and clearly indicating the complete plan, location, and elevations of the cabinets and accessories and pertinent details of construction, fabrication, and attachments.

SD-03 Product Data

Cabinets; G A/E

Countertops and Backsplash; G A/E

Manufacturer's printed data, catalog cuts, installation and cleaning instructions.

SD-04 Samples

Cabinets

Countertops and Backsplash

In lieu of individual samples, complete minimum size cabinets may be furnished as samples. Mock-up units are not acceptable. Samples shall be of sufficient size to show color, pattern, and method of assembly.

- a. Countertop and backsplash - One section, containing both.
- b. Door and drawer front - One of each, with hardware mounted.
- c. Countertop color samples approximately 50 x 75 mm size.
- d. Stain/color samples approximately 50 x 75 mm size.

SD-06 Test Reports

Cabinets and Countertops

Test reports certifying that all cabinets comply with the requirements of KCMA ANSI/KCMA A161.1. Tests shall be conducted by independent laboratories approved by KCMA. KCMA certification seals affixed to the cabinets will be accepted in lieu of certified test reports.

Test report results from and independent testing laboratory attesting that the submitted solid polymer material meets or exceeds each of the specified performance requirements.

SD-10 Operation and Maintenance Data

Solid polymer material

A minimum of six copies of maintenance data indicating manufacturer's care, repair, and cleaning instructions.

1.4 DELIVERY AND STORAGE

Cabinets shall be delivered to the jobsite wrapped in a protective covering. Cabinets shall be stored in accordance with manufacturer's recommendations in an adequately ventilated, dry location that is free of dust, water, or other contaminants and in a manner to permit access for inspection and handling. Cabinets shall be handled carefully to prevent damage to the surfaces. Damaged items that cannot be restored to like-new condition shall be replaced.

1.5 WARRANTY

Manufacturer's warranty against defects in materials: 10 years. Warranty shall provide for material and labor for replacement or repair of defective material.

PART 2 PRODUCTS

2.1 CABINETS

Wall and base cabinets shall be of the same construction and same outside appearance. Door design shall be solid flush face from vendors standard styles. Corner cabinets shall be equipped with notched shelving. Shelves shall be fixed or fully adjustable as indicated. Adjustable shelves shall be capable of adjusting on approximately 75 mm increments. Shelves shall be supported and recessed as indicated. Shelves shall be minimum 13 mm thick plywood or minimum 13 mm thick 20 kg density particle board. Drawer fronts shall be 20 kg density, 11 mm thick solid wood panel.

2.1.1 Frame Type Cabinets

The cabinets shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 19 mm thick by 38 mm wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Top and bottom corners shall be braced with either hardwood blocks that are glued together with water resistant glue and nailed in place, or metal or plastic corner braces. Backs of wall cabinets shall be 3 mm thick plywood or tempered hardboard. Backs of base and tall cabinets shall be 9 mm thick hardwood. Bottoms of cabinets shall be minimum 9 mm thick plywood or good grade plywood and shall be braced with wood members glued in place. Cabinet ends shall be 16 mm thick hardwood plywood.

2.1.2 Frameless Type Cabinets

The cabinets shall be of frameless design and construction. Cabinets shall be constructed of minimum 16 mm thick, 20 kg density particle board end and floor panels. Cabinet back shall be constructed of minimum 5 mm thick, 20 kg density particle board. Hanging rails shall be doweled and glued to end panels, then fastened and hot melt glued to cabinet back. Toe kick plates shall be recessed, doweled and glued to the end panels. Top and bottom

corners shall be braced with either hardwood blocks glued together with water resistant glue and nailed in place, or fastened with metal or plastic corner braces.

2.2 COUNTERTOPS AND BACKSPLASH

2.2.1 High-Pressure Laminated Plastic Clad Countertops

Clad countertop and backsplash shall be constructed of 19 mm thick plywood or 19 mm thick, 20 kg density particle board core and shall be post formed cove type or fully formed type. Cove type shall be a single unit with self-edging and plastic laminate coved at the juncture of the countertop and backsplash. Fully formed type or square edge shall be a unit with shaped edges using wood nose molding at counter edge and shall include a separate backsplash. Backsplash shall be not less than 90 mm high. Edging and trim shall consist of plastic laminate cut and fitted to all exposed edges. End splashes constructed of 19 mm plywood or 19 mm thick, 20 kg density particle board core shall be supplied. Continuous sheets of longest lengths practicable shall be provided. Joints in surface sheeting shall be tight and flush and held to a practicable minimum. When the countertop and backsplash are two separate units, GP50 plastic laminate shall be used. When the countertop and backsplash are one unit, PF42 plastic laminate shall be used. Plastic laminate shall conform to the requirements of NEMA LD 3 and plastic laminate adhesive shall be contact type applied to both surfaces. For fully formed and cove type countertops, the post-forming plastic laminate shall not be bent to a radius smaller than the limit recommended by the plastic manufacturer.

2.2.2 Solid Polymer countertop and backsplash

Countertop and backsplash shall be constructed of sheet material for sink/lavatory cutout; as shown. Material shall be 19 mm thickness, cast, and filled nonporous solid surfacing composed of acrylic polymer, mineral fillers, and pigments, meeting ANSI Z124.3 requirements. Superficial damage to a depth of 0.25 mm shall be repairable by sanding or polishing. Material shall comply with the following performance requirements.

- a. Tensile Strength; 18.3 N/mm^2 , when tested in accordance with ASTM D 638.
- b. Hardness; Barcol Impressor 50 when tested in accordance with ASTM D 2583.
- c. Flammability; rated Class I with a flame spread of 25 maximum and a smoke developed of 100 maximum when tested in accordance with ASTM E 84.
- d. Boiling water resistance; no effect when tested in accordance with NEMA LD 3.
- e. High temperature; no effect when tested in accordance with NEMA LD 3.
- f. Liquid absorption; 0.06% maximum (24 hours) when tested in accordance with ASTM D 570.
- g. Sanitation; National Sanitation Foundation approval for food contact in accordance with Standard 51 and approval for food area applications.

- h. Impact resistance; no failure for ball drop when tested in accordance with NEMA LD 3.

2.3 Sink

Sink shall be of the corrosion resistant stainless steel clamping type, sized to the sink, and a standard product of a manufacturer regularly producing this type of equipment. See Specification 15400.

2.4 FINISH

2.4.1 Backer Sheets

Backer Sheets of high pressure plastic laminate, shall conform to NEMA LD 3, Grade BK20 and shall be applied to the underside of all core material.

2.5 HARDWARE

Hardware shall conform to BHMA A156.9, shall be suitable for cabinet use, and shall include all miscellaneous hardware for a complete installation. Door hinges shall be self-closing type. Drawer runners shall have nylon rollers standard with the manufacturer. Hardware and fastenings for doors and drawers shall be of the through-bolt type. The types and finishes of hardware shall be as follows:

- a. Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware".
- b. Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- c. Butt hinges shall be 70 mm, 5-knuckle steel hinges made from 2.4 mm thick metal and semiconcealed for Overlay Doors in accordance with BHMA A156.9, B01521.
- d. Wire pulls shall be back mounted, 100 mm long, 8 mm in diameter.
- e. Door pulls for display cases similar to SND-120/M, and SD-80, 304 stainless steel finish, by Lamp Sugatsune, or an equal product.
- f. Catches shall be magnetic in accordance with BHMA A156.9, B03141, and B03132 for cabinet doors in Conference Rooms.
- g. Adjustable shelf standards and supports: BHMA A156.9, B04071; with shelf rests, B04081.
- h. Shelf rests: BHMA A156.9, B04013.
- i. Drawer slides shall be side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
 - 1. Box Drawer Slides: 330N.
 - 2. File Drawer Slides: 670N.
 - 3. Pencil Drawer Slides: 200N.
 - 4. Keyboard Slide: 330N.
- j. Door Locks: BHMA A156.11, E07121.

- k. Drawer Locks: BHMA A156.11, E07041.
- l. Grommets for Cable Passage through Countertops shall be 51 mm OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- m. For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630 (US32D).

2.6 COLOR, TEXTURE, AND PATTERN

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Design, color, and finish shall match samples given ~~in Section 09020~~ on Drawing I-002, Finish Legend.

PART 3 EXECUTION

3.1 INSTALLATION

Cabinets shall be installed level, plumb, and true to line, and shall be attached to the walls or floors with suitable devices to securely anchor each unit. Countertops, accessories, and hardware shall be installed as indicated on the drawings. Installation shall be in accordance with the manufacturer's approved printed instructions. The inner edge of sink cut-outs in laminated plastic tops shall be painted with a coat of semigloss enamel paint and sink flanges shall be set in a bed of sealant. Closer and filler strips and finish moldings shall be provided as required. Prior to final acceptance, doors shall be aligned, and hardware shall be adjusted.

3.2 CLEANING

Cabinet and countertop surfaces shall be cleaned in accordance with manufacturer's instructions.

-- End of Section --

SECTION 12350

LABORATORY CASEWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of laboratory casework and fixtures are shown on the drawings. The responsibilities and duties of the Contractor and casework contractor are specified below as a basis of establishing quality assurance and coordination.
- B. Work provided by the casework contractor includes the fabrication and installation of metal laboratory casework components. Components consist of base cabinets, wall cabinets, storage cabinets, tables, cabinet tops, lab type sinks, fume hood cabinets, under-structures for fume hoods, flexible work stations, lab type shelf units, accessories and other casework units as indicated on the drawings by keynotes beginning with "12350."
- C. Piped utility service fixtures, as denoted in Part 2, are supplied loose by casework contractor. Installation of service fixtures and connection to piped utilities is the responsibility of the Contractor and is specified in Division 15.
- D. Waste Lines and traps are to be furnished and installed by the Contractor under Division 15. All sinks provided and installed by casework contractor are listed in Part 2 of this section. These sinks are provided with a tailpiece. The Contractor is to furnish and install all piping and fittings downstream from tailpiece under the requirements of Division 15.
- E. The electrical raceway, electrical devices, cover plates, etc. attached to the reagent shelving will be provided loose by the casework manufacturer and installed and wired by the Contractor. All other electrical devices, wiring, electrical raceway products and ground connections are, unless noted otherwise, provided and installed by the Contractor as specified in Division 16. Cutouts in laboratory casework for the installation of electrical devices are the responsibility of the casework contractor.
- F. All paper towel dispensers, fire extinguishers and cabinets, safety supply cabinets and supplies are provided and installed by the Contractor. Cutouts in casework for the installation of the items indicated on the contract drawings are the responsibility of the casework contractor.
- G. Resilient base is specified in Division 9 and is the responsibility of the Contractor.
- H. Wood blocking and supports for wall hung casework are the responsibility of the Contractor under Division 6. Contractor to

coordinate the locations of in-wall blocking using the shop drawings provided by casework contractor.

I. Sealants are specified under Division 7 and are the responsibility of the Contractor.

J. Related Sections:

1. Laboratory Equipment, Division 11.
2. Laboratory Fume Hoods, Division 11.
3. Mechanical and Plumbing, Division 15.
4. Electrical, Division 16.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01330 "Submittal Procedures" for each item listed in Article 1.1.

B. SD-02 Shop drawings:

1. Approved Detail Drawings; G, A/E.
2. For laboratory casework showing plans, elevations, ends, cross-sections, service run spaces, location and type of service fixtures. Show details and location of anchorage's and fitting to floors, walls, and base. Include layout of units with relation to surrounding walls, doors, windows, in-wall electrical outlets and other building components. Coordinate shop drawings with other trades involved. Indicate all in-wall blocking and rough-in requirements for coordination with other trades.

C. SD-03 Product Data

1. Laboratory Casework, Sinks, Countertops, Mechanical Service Fixtures, Eye Wash, Safety Shower; G, A/E.
2. Submit manufacturer's data and installation instructions for each type of laboratory casework unit, fixtures, and accessories.

D. SD-04 Samples

1. Laboratory Casework and Countertops; G, A/E.
2. In lieu of individual samples, complete minimum size casework may be furnished as samples. Mockup units are not acceptable. Samples shall be of sufficient size to show color, pattern, and method of assembly.
3. Submit 152 mm x 152mm samples of each type of specified finishes, including countertop materials. Architect will review samples for color, texture, and pattern only. Compliance with other specified requirements is exclusive responsibility of casework contractor.

E. SD-07 Certificates

1. Laboratory Casework, Countertops, Flammable Liquids Storage Cabinets, Acid Storage Cabinets; G, A/E.
2. Certificates attesting that the casework meets the requirements specified.

3. Finish: Include independent laboratory certification that applied finish complies with specified chemical and physical resistance requirements.
4. Performance Requirements: Submit independent laboratory certification that casework complies with the specified performance requirements.

F. SD-08 Manufacturer's Instructions:

1. Laboratory Casework; G, A/E.
2. Submit operation and maintenance data in accordance with Division 1 Section "Operation and Maintenance Data."
3. Operation Instruction: Submit 2 copies of operating and maintenance instructions for each fume hood, provided in booklet form providing information on adjustment, operation and maintenance of hood.

G. SD-10 Operation and Maintenance Data:

1. Laboratory Casework, Countertops, Eye Wash, Safety Showers; G, A/E.
2. Submit operation and maintenance data in accordance with Division 1 Section "Operation and Maintenance Data."

1.3 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide laboratory casework with tops, sinks, and service fixtures, manufactured or furnished by a single laboratory casework company for single responsibility. Laboratory fume hoods specified in Section 11610 must be fully integrated with casework as shown on drawings and shall be furnished by a single laboratory supplier.
- B. Provide written warranty signed by the manufacturer guaranteeing to correct failures in products which occur within the warranty period indicated below, without reducing or otherwise limiting any other rights to correction which the Owner may have under the Contract Documents. Correction may include repair or replacement. Correct failures which occur within the following warranty period(s) after the final acceptance:
 1. All components: 1 year
 2. Metal cabinets: 3 years

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- C. ~~The AWI grade of wood shall be Custom or better.~~
- D. Chemical and Physical Resistance of Finish: Submit an independent testing laboratory report certifying that the exterior finish of laboratory casework is capable of withstanding following tests, with no change, or slight change of gloss, slight discoloration, or slight temporary softening of film with no loss of adhesion and no loss of film protection.

1. Acids: Not less than 10 drops (0.5 cc) applied to finish surface, covered with watch glass concave side down for 60 minutes, then washed and dried.
 - a. 50% Acetic Acid
 - b. 98% Acetic Acid
 - c. 20% Hydrochloric Acid
 - d. 37% Hydrochloric Acid
 - e. 10% Nitric Acid
 - f. 30% Nitric Acid
 - g. 50% Phosphoric Acid
 - h. 75% Phosphoric Acid
 - i. 25% Sulfuric Acid
 - j. 70% Sulfuric Acid
2. Solvent: Not less than 10 drops (0.5 cc) applied to finish surface, covered with watch glass concave side down for 60 minutes, then washed and dried.
 - a. Acetone
 - b. Benzene
 - c. Butyl Alcohol
 - d. Carbon Tetrachloride
 - e. Ethyl Acetate
 - f. Ethyl Alcohol
 - g. Ethyl Ether
 - h. Formaldehyde, 37%
 - i. Furfural
 - j. Gasoline
 - k. Glycerin
 - l. Kerosene
 - m. Methyl Alcohol
 - n. Methyl Ethyl Ketone
 - o. Naphtha
 - p. Toluene
 - q. Xylene
3. Bases and Salts: Not less than 5 drops (0.25 cc) applied to finish surface, covered with watch glass convex side down for 60 minutes, then washed and dried.
 - a. 10% Sodium Hydroxide
 - b. 40% Sodium Hydroxide
 - c. 28% Ammonium Hydroxide
 - d. 40% Potassium Hydroxide
 - e. 10% Potassium Hydroxide
 - f. Saturated Zinc Chloride
 - g. Saturated Sodium Chloride
 - h. Saturated Sodium Sulfide
 - i. Saturated Sodium Carbonate
4. Moisture Resistance: No visible effect when finish surface exposed to the following:
 - a. Hot water at a temperature of 91 to 96 degrees C trickled down surface at 45-degree angle for 5 minutes.

- b. Constant Moisture using a 50 mm x 76 mm x 25mm cellulose sponge, soaked with water, in contact with surface for 100 hours.
- 5. Cold Crack: No effect when subjected to 10 cycles of temperature change from 14 to 52 degrees C for 60 minutes.
- 6. Adhesion and Flexibility: No peeling or cracking or exposure of metal when metal is bent 180 degrees over a 13 mm diameter mandrel.
- 7. Adhesion: Ninety or more squares of the test sample shall remain coated after the scratch adhesion test.
- 8. Hardness: The finish shall have a hardness of 4-H using the pencil hardness test.

1.4 DEFINITIONS

- A. Service Fittings and Fixtures: Service fittings include gas, air, vacuum and special gas petcocks and turrets; lab type hot and cold water faucets; remote control valves for fume hoods; vacuum breakers; deck mounted eye-washers; laboratory sinks, and cup sinks.
- B. Rough-In Point: Individual or common supply of mechanical, electrical, and heating, ventilating and air conditioning (HVAC) through wall, floor, or ceiling, generally located within the utility umbilical, equipment chase, or service space behind cabinets.
- C. Related Equipment: Items not generally manufactured by casework contractor but furnished and installed as part of casework contractor's work.

1.5 PROJECT SITE CONDITIONS

- A. Site Access: Provide access for vehicle delivery. Keep receiving area and corridors clear of materials and work to allow access to installation areas.
- B. Building Finish: Prior to delivery of laboratory casework, conduct a review of the facility to confirm that the following requirements are met. To ensure an orderly installation and to minimize damage to laboratory casework, complete the listed final building systems:
 - 1. Environmental Conditions: Complete exterior envelope including roofing, wall systems, exterior glazing, joint sealers, doors, interior walls, finishes, HVAC, sprinkler, plumbing, electrical systems to protect equipment from the temperature, humidity, construction activity, elements and to provide security for stored equipment.
 - 2. No water intrusion or leaks are permitted. Complete all water and moisture producing operations such as masonry, terrazzo, and plasterwork, allowing for drying and curing.
 - 3. Certify floor level tolerances as specified in Division 9, allowing an even surface for equipment installation. Install interior floor finish.
 - 4. Painted walls.

5. Ceiling grid and panels.
6. Branch electrical circuits and grounding conductors.
7. Air conditioning system with diffusers.
8. Sprinkler lines with heads.
9. Lighting.
10. Mechanical lines including tests for leaks.
11. Cold weather: Provide temporary or permanent heat to maintain ambient room temperatures in a range of 13-20 degrees C.
12. Power Requirements: Provide temporary or permanent electric power to rooms for laboratory casework installations.
13. Rough-in connections to laboratory casework and equipment: Coordinated with the Approved Shop Drawings for service, size and location, allowing for final hook-up and connections.

- a. Test service lines such as water, gas, vacuum, and special gases for leaks. Clean and cap for connection of service fittings.

14. Rooms in which laboratory casework is to be installed shall be broom clean.

C. Maintain final design temperature and humidity in areas where casework is stored and installed.

D. Fit casework to actual construction. If it is not possible or practical to take field measurements before fabricating, provide adequate installation tolerances and scribe or trim to fit.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood laboratory casework only after wet operations in building are completed. The Contractor is required to schedule activities in such manner that the condition of the building does not delay the delivery and installation of casework by the casework installer.

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~~B. Wood laboratory casework shall be stored only in a ventilated place, protected from the weather, with relative humidity therein of 50 percent or less at 22 degrees C.~~

C-B. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

D-C. If installation cannot commence in a timely manner due to conditions beyond the control of casework installer, casework and equipment may be placed in storage. Additional costs for handling, shipping and storage shall be borne by the Contractor.

E-D. A secure, locked storage area shall be provided by the Contractor to the installer for use to safeguard this equipment at the job site prior to distribution to the proper trades for installation for high value items, such as service fittings, that may be shipped to the job

site on larger projects and used over the course of several months installation.

F.E. Laboratory casework and counters are not to be used as workbenches or work platforms for any portion of the work by any trade. Furniture and casework, as installed, is considered to be finished equipment and shall be protected from damage by all trades.

G.F. Painting and other finishing trades: At no time shall the installed work surface be used by tradesmen as a workbench. It is the responsibility of the Contractor to perform minor wall touch-up around casework and to caulk between casework and wall as indicated on drawings. The Contractor shall protect installed laboratory casework and equipment, especially the laboratory work surface, from debris, paint and damage in the course of the construction sequence.

H.G. Mechanical and Electrical Trades: Where access is required through items of laboratory casework, it shall be the mechanical or electrical contractors' responsibility to remove said access panels, drawers, etc., where they occur, make their connections and replace such access panels, drawers, etc. at their own expense.

PART 2 - PRODUCTS

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2.1 FLUSH OVERLAY STEEL CASEWORK ~~WITH WOOD DOOR AND DRAWER FRONTS~~

A. Flush Overlay Construction:

1. Surfaces of doors and drawers shall overlay the cabinet ends, top or bottom rails. Horizontal and vertical case shell members, panels, top rails and bottoms, shall be concealed behind drawer and door fronts. Reveals shall be a uniform 3 mm, vertically and horizontally, between adjacent drawer and door fronts.

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~~B. Grain Pattern on wood cabinet fronts to be vertical matched grain. Continuous vertical grain match on door and drawer fronts of individual cabinets.~~

C.B. Slimline Styling: Front width of end panels 19 mm and front height of top and bottom members 25 mm.

D.C. Self-Supporting Units: Completely welded shell assembly without applied panels at ends, backs or bottoms, so that cases can be used interchangeably or as a single, stand-alone unit.

E.D. Interior of case units: Easily cleanable, flush interior. Base cabinets, 762 mm and wider, with double swinging doors shall provide full access to complete interior without center vertical post.

F-E. Drawers: Sized on a modular basis for interchange to meet varying storage needs, and designed to be easily removable in field without the use of special tools.

G-F. Case openings: Rabbeted-like joints all four sides of case opening for hinged doors and two sides for sliding doors in order to provide structural integrity.

H-G. Framed glazed doors: Identical in construction, hardware and installation to solid panel doors. Design frame glazed doors to be removable for glass replacement.

2.2 CASEWORK PERFORMANCE REQUIREMENTS

A. Structural Performance Requirements: Casework components shall withstand the following minimum loads without damage to the component or to the casework operation:

1. Steel base unit load capacity: 225 kg per lineal foot.
2. Suspended units: 135 kg.
3. Drawers in a cabinet: 167 kg.
4. Utility tables (4 legged): 135 kg.
5. Hanging wall cases: 135 kg.
6. Load capacity for shelves of base units, wall cases and tall cases: 45 kg.

B. Metal Finish Performance Requirements:

1. Abrasion resistance: Maximum weight loss of 5.5 mg per 100 cycle when tested on a Taber Abrasion Tester #E40101 with 1000 gm wheel pressure and Calibrase #CS10 wheel.
2. Hardness: Surface hardness equivalent to 4H or 5H pencil.
3. Moisture resistance:
 - a. No visible effect to surface finish after boiling water trickled over test panel inclined at 45 degrees for five minutes.
 - b. No visible effect to surface finish following 100-hour continuous application of a water soaked cellulose sponge, maintained in a wet condition throughout the test period.
4. Adhesion: Score finish surface of test panel with razor blade into 100 squares, 1.5 mm x 1.5 mm, cutting completely through the finish but with minimum penetration of the substrate, and brush away particles with soft brush. Minimum 95 squares shall maintain their finish.
5. Salt spray: Withstand minimum 200-hour salt spray test.

2.3 CASEWORK MATERIALS

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~~A. Hardwood Plywood: HPVA HP-1, either veneer core or particle core, unless otherwise indicated.~~

B-A. Sheet Steel: Mild, cold rolled and leveled unfinished steel.

C-B. Minimum Gauges:

1. 20 gauge: Interior drawer fronts, scribing strips, filler panels, enclosures, drawer bodies, shelves, security panels and sloping tops.
2. 18 gauge: Case tops, ends, bottoms, bases, backs, vertical posts, uprights, and access panels.
3. 16 gauge: Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
4. 14 gauge: Drawer suspensions, door and case hinge reinforcements and front corner reinforcements.
5. 11-gauge: Table leg corner brackets and gussets for leveling screws.

D-C. Glass for glazed swinging or unframed doors:

1. 6 mm clear float glass: ASTM C 1036, Type I, Class 1, double strength, quality q3 (Grade B).

2.4 CASEWORK FABRICATION

A. Base Units and Cases:

1. Base units and 635 mm, 787 mm, and 940 mm high wall cases: End panels and back reinforced with internal reinforcing front and rear posts. Base units shall be 559 mm overall in depth.
2. 1245 mm and 2134 mm high cases: Formed end panels with front and rear reinforcing post channels; back shall be formed steel panel, recessed 19 mm for mounting purposes.
3. Posts: Front post fully closed with full height reinforcing upright. Shelf adjustment holes in front and rear posts shall be perfectly aligned for level setting, adjustable to 13 mm centers.
4. Secure intersection of case members with spot and arc welds. Provide gusset reinforcement at front corners.
5. Base unit backs: Provide drawer units without backs and cupboard units with removable backs for access to services behind units.
6. Bottoms: Base units and 635 mm, 787 mm, 939 mm, and 1244 mm high wall cases shall have one piece bottom with front edge formed into front rail, rabbeted as required for swinging doors and drawers and flush design for sliding doors.
7. Top rail for base units: Interlock with end panels, flush with front of unit.
8. Horizontal intermediate rails: Recessed behind doors and drawer fronts.
9. Base for base units: 102 mm high x 76 mm deep with formed steel base and 11 gauge die formed steel gussets at corners. Provide 9.5 mm diameter leveling screw with integral bottom flange of minimum 3.6 sq. cm at each corner, accessible through openings in toe space.
10. Tops of wall cases: One piece, with front edge formed into front rail.

B. Drawers:

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1. ~~Wood~~ Metal Drawer fronts: 18 gauge metal, 19 mm thick, double wall construction, pre-painted prior to assembly and sound deadened; top and front corners welded and ground smooth.~~solid core 3-ply construction veneered two sides and banded four sides with 3 mm hardwood.~~
 - a. ~~Face Veneer: Plain-sliced Northern Red Oak, Grade A, selected for golden wheat color and narrow hearts of no more than 127 mm width. No split hearts allowed. Book matched only.~~
2. Drawer bodies: Bottom and sides formed into one-piece center section with bottom and sides coved and formed top edges. Front and back panels spot-welded to center section.
3. Drawer suspension: Heavy duty coved raceways for both case and drawer with nylon tired, ball bearing rollers; self-centering and self-closing when open to within 127 mm of the closed position.
4. Provide drawer with rubber bumpers. Friction centering devices are not acceptable.
5. Provide security panels for drawers with keyed different locks.
6. File drawers: Provide with 167 kg full extension slides for full access and operation.

C. Doors:

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- ~~1. Wood~~ Metal Door fronts: 19 mm thick, double wall, telescoping box steel construction with interior pre-painted and sound deadened, all outer corners welded and ground smooth. Reinforce interior front panel with welded steel hat channels. Secure hinges with screws to internal 14 gauge reinforcing in case and door. Hinges shall be removable; welding of hinges not acceptable. Doors shall close against rubber bumpers.~~solid core 3-ply construction veneered two sides and banded four sides with 3 mm hardwood.~~
 - a. ~~Face Veneer: Plain-sliced Northern Red Oak, Grade A, selected for golden wheat color and narrow hearts of no more than 127 mm width. No split hearts allowed. Book matched only.~~
2. Frame glazed doors: Solid core construction: 19 mm x 70mm frame stock machined to accept glass. Provide extruded vinyl retaining molding designed so glass can be replaced without tools. Meeting edges of pairs of doors to include overlapping astragals, right over left. In all other respects, framed glazed door construction and quality shall match solid panel doors.

D. Shelves:

1. Form front, ends, and back edges down and back 19 mm.
2. Reinforce shelves over 914 mm long with welded hat channel reinforcement the full width of shelf.
3. Pull out shelves: Same suspension as specified for drawers.

- E. Base molding: 101 mm high, to be furnished and installed by flooring contractor.
- F. Hardware:

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1. ~~Wood~~Metal Drawer and hinged door pulls: Steel with powder paint finish, screw attached on 102 mm centers.
2. Sliding door pulls: Recessed stainless steel, styled and sized to harmonize with drawer pulls.
3. Hinges: Institutional type, five knuckle projecting barrel hinges, minimum 63 mm long, steel with powder paint finish. Provide two hinges for doors up to 914 mm high; three hinges for doors over 914 mm high. Drill each leaf for three screw attachment to door and frame.
4. Door catches: Adjustable type, spring actuated nylon roller catches.
5. Elbow catches: Spring type of cadmium plated steel, with strike of suitable design.
6. Locks: National Lock Remove-A-Core 5-disc tumbler, heavy-duty cylinder type. Exposed lock noses shall be dull nickel (satin) plated and stamped with identifying numbers.
7. Keying: Locks, where shown on drawings, shall have capacity for 225 primary key changes. Master key one level with the potential of 40 different, non-interchangeable master key groups.
8. Keys: Stamped brass available from manufacturer or local locksmith, and supplied in the following quantities unless otherwise specified:
 - 2 - for each keyed different lock.
 - 3 - for each group keyed alike locks.
 - 2 - for master keys for each system.
9. Label holders: Formed steel with powder paint finish, 25 mm x 38 mm, screw installed.
10. Shelf clips: Die formed steel, zinc plated, designed to engage in shelf adjustment holes.
11. File Followers: Metal back engaging in steel bottom channel, with spring positioning lock.

2.5 ADJUSTABLE HEIGHT LABORATORY TABLES

- A. Adjustable Tables shall be constructed as indicated on the Drawings, and as follows:
 1. Type 1: 1200 mm x 750 mm.
 2. Type 2: 1500 mm x 750 mm.
 3. Type 3: 1800 mm x 750 mm.
 4. Type 4: 1500 mm x 750 mm, with cut out as shown.
- B. Tables shall have 25.4 mm x 25.4 mm stainless steel telescoping legs fitted with 38.1 mm diameter adjustable non-marring floor glides with 25.4 mm micro-adjustment capability. Tables shall have the ability to be adjusted in height from 787.4 mm to 965.2 mm inclusive of 25.4 mm

thick counter top. Tables shall be installed at height indicated on Drawings. Fixed wood section of leg shall be set at height appropriate for a 325.4 mm high table top and adjustable portion of leg shall be stainless steel, drilled at 25.4 mm increments or as otherwise indicated on the drawings, and concealed within each wood table leg. Tables shall be reinforced with 50 mm deep welded steel channel frame concealed by wood elements. Load capacity of tables, 2286 mm long shall be 456.3 kg, uniformly loaded and support a 113.4 kg concentrated load at midspan, with deflection not to exceed 3 mm. Provide a countersunk stainless steel slide plate at underside of each wooden leg and provide chain for each pin support.

- C. Provide two (2) scissor-type lift carts capable of raising tables off floor without marring finish in order to permit height adjustment. Unit shall be capable of operating at both sitting and standing height. Unit shall be fabricated of materials compatible with decontamination procedures involving the use of steam and paraformaldehyde application.

2.6 FLAMMABLE LIQUIDS STORAGE CABINETS

- A. Constructed of 18 gauge cold-rolled steel with double walls containing a 38 mm air space. Door shall be provided with continuous piano hinge and three-point latch arrangement with door sill raised at least 51 mm above the bottom of the cabinet to retain spilled liquid within the cabinet. Door shall be self-closing with a fusible link. Cabinets shall meet the requirements of OSHA 29 CFR 1910.106D, NFPA 30, and shall have Factory Mutual approval. Provide labels or certification by an independent testing laboratory.
 - 1. Comply with requirements of metal cabinet construction. Cabinets shall be labeled with hazard warning signage on the door in compliance with ANSI Z-535.
 - 2. Cabinets shall have a grounding connection point on the back side for wiring to the buildings grounding system.
 - 3. Cabinets shall have grounding connection point at the base of the cabinet for firm attachment of the grounding wire to the building grounding system.

2.7 ACID STORAGE CABINETS

- A. Comply with requirements of metal cabinet construction. Line acid storage cabinets with corrosion resistant polyethylene liner and provide a louver at the bottom of each door.
 - 1. Furnish a half depth lined adjustable shelf for the full width of the cabinet.
 - 2. Bottom of cabinet to be furnished with a 6 mm thick heat welded, liquid tight, removable 25 mm deep polypropylene pan.
 - 3. Cabinets shall be labeled with hazard warning signage on the door in compliance with ANSI Z-535.
 - 4. Cabinets shall be vented into fume hoods when mounted below fume hoods. Provide 38 mm inside diameter corrosion resistant vent pipe up to fume hood enclosure. Locate vent openings at rear of

fume hood work area with raised lip to avoid acting as a drain to work surface. Vent should provide positive airflow directly into the fume hood exhaust system.

2.8 METAL FINISHES

- A. Preparation: Spray clean metal with a heated cleaner/phosphate solution. Pretreat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.
- B. Application: Electrostatically apply urethane powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:

1. Exterior and interior surfaces exposed to view:

- a. 1.5 mil average and 1.2 mil minimum.

2. Backs of cabinets and other surfaces not exposed to view:

- a. 1.0 mil average.

C. Chemical Resistance:

1. Test procedure: Apply 10 drops (approximately 0.5 cc) of each reagent identified to the surface of the finished test panels laid flat and level on a horizontal surface.

- a. Ambient temperature: 20-22 degrees C. After one hour flush away chemicals with cold water and wash surface with detergent and warm water at 65 degrees C, and with alcohol to remove surface stains.

2. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:

- a. Excellent: Indicates excellent to superior integrity of finish film. Includes no effect of slight change in gloss and slight discoloration.
- b. Good: Allows change of gloss or discoloration or slight swelling while retaining integrity of finish film.
- c. Failure: Obvious and significant deterioration, including blistering, pitting, cratering, erosion and/or loss of finish material.

3. Test results (concentration by weight) Steel Casework:

<u>CHEMICAL</u>	<u>RATING</u>
a. Acetic Acid, 93%	Excellent
b. Formic Acid, 33%	Good
c. Hydrochloric Acid, 37%	Excellent
d. Nitric Acid, 25%	Excellent

e.	Nitric Acid, 60%	Good
f.	Phosphoric Acid, 75%	Excellent
g.	Sulfuric Acid, 28%	Excellent
h.	Sulfuric Acid, 85%	Excellent
i.	Ammonium Hydroxide, 10%	Excellent
j.	Sodium Hydroxide, 10%	Excellent
k.	Sodium Hydroxide, 25%	Excellent
l.	Acetone	Excellent
m.	Carbon Tetrachloride	Excellent
n.	Ethyl Acetate	Excellent
o.	Ethyl Alcohol	Excellent
p.	Ethyl Ether	Excellent
q.	Formaldehyde, 37%	Excellent
r.	Hydrogen Peroxide, 5%	Excellent
s.	Methylethyl Ketone	Excellent
t.	Phenol, 85%	Good
u.	Xylene	Excellent

- D. Finish drawer bodies in matching or harmonizing color and apply corrosion-resistant treatment to selected, concealed interior parts.
- E. Provide independent certified test report on chemical resistance of finish.

2.9 TOPS

- A. Provide cabinet and counter tops of the following materials where shown on drawings. Provide steel channel reinforcing at work surfaces with aprons spanning 1200 mm or greater. Edge of work surface should be capable of supporting a 91 kg point load.
- B. Cast Epoxy Resin or Solid Composite Phenolic: Factory molded tops of modified epoxy resin or factory produced solid phenolic resin formulation, with a uniform mixture throughout full thickness. Color to be as designated on drawings. Finish to be flat or matte finish.
 - 1. Tops, Box Curbs, Splash Rim: Provide smooth, clean, exposed tops and edges, in uniform plane, free of defects. Supply loose curbs and backsplashes for field application in same thickness as countertops. Exposed edges to be radiused to 3 mm unless noted otherwise on drawings. Top lengths and widths as shown on drawings. Tops shall have factory cutouts for specified service fixtures.
 - 2. Top Thickness: Provide 19 mm thick tops in the longest practical lengths. At sink locations provide with integral 6 mm marine edge to provide an overall thickness of 25 mm. Maintain 25 mm thickness with tolerance not exceeding plus or minus 0.8 mm. Provide front overhang of 25 mm over base cabinets, formed with continuous drip groove on under surface, 13mm from edge, and 6 mm overhang at each end.
 - 3. Physical Properties:
 - a. Flexural strength: 98 Mpa.
 - b. Compressive strength: 210 Mpa.

- c. Hardness: Rockwell E - 100.
 - d. Water absorption in 24 hours: 0.04 percent.
 - e. Heat distortion point: 176 degrees C.
 - f. Highly resistant to thermal shock.
4. Chemical Resistance: Spot test of following reagents in standard laboratory concentrations, in contact with finished top for 24 hours. Top shall be entirely unaffected or show only slight dulling of finish:
- a. Acetic acid, Glacial
 - b. Acetic acid, 98%
 - c. Acetone
 - d. Ammonium hydroxide, 28%
 - e. Benzene
 - f. Butyl alcohol
 - g. Carbon Tetrachloride
 - h. Calcium hypochlorite
 - i. Chromic acid, 60%
 - j. Ethyl acetate
 - k. Ethyl alcohol
 - l. Ethyl ether
 - m. Formaldehyde, 37%
 - n. Formic Acid, 90%
 - o. Hydrochloric acid, 37%
 - p. Hydrogen peroxide, 28%
 - q. Kerosene
 - r. Methyl alcohol
 - s. Methyl Ethyl Ketone
 - t. Nitric acid, 70%
 - u. Phenol, 85%
 - v. Phosphoric acid, 85%
 - w. Silver nitrate
 - x. Sodium Carbonate, 20%
 - y. Sodium hydroxide, 40%
 - z. Sulfuric acid, 96%
 - aa. Toluene
 - bb. Trichloroethylene
 - cc. Xylene
 - dd. Zinc chloride
5. Workmanship: Cast surfaces very smooth using hand-polished molds, with factory cutouts for sinks and drip grooves. Plain butt-type joints in epoxy tops shall be assembled with epoxy adhesive and pre-fitted, concealed metal spline.

C. Plastic Laminate:

- 1. Provide chemical resistant, high-pressure plastic laminate sheets, color throughout entire thickness with satin finish, complying with NEMA LD-3. Use general-purpose grade 1.25 mm thick for flat tops and post-forming grade, and 1 mm thick on formed tops.
- 2. Shop-bonded with fully waterproof bond glue to 19mm thick sub-top hardwood faced plywood, medium density overlaid plywood, or

phenolic-resin-bonded particleboard. Use backer sheet on bottom of sub-tops.

3. Sand smooth surfaces to which plastic laminate is to be bonded.
4. Build up exposed edges of tops to 25 mm thickness. Band exposed edges with 3 mm PVC material. Band 3 mm PVC edge after applying laminate to deck. Provide material in same color as plastic laminate used for tops unless noted otherwise on the drawings.
5. Supply loose curbs for field application in same thickness as countertops.
6. Color to match epoxy tops.

D. Stainless Steel:

1. Provide 14 gauge stainless steel sheet, AISI Type 304 with No. 4 satin finish. Weld shop joints, grind smooth and polish to become practically invisible. Keep field jointing to a minimum. Apply reinforcing channels to underside of top where necessary to insure rigidity without deflection.
2. Extend top down to provide a 25 mm thickness and a 13 mm return flange under frame.
3. Form backsplash to be coved to and integral with top surface. Provide 45-degree beveled top edge.
4. Provide a 5 mm or 6 mm raised marine edge around perimeter of tops containing sinks. Pitch top surface two ways to bowl to provide adequate drainage without channeling or grooving.
5. Where stainless steel sinks occur in stainless steel tops, factory assemble sinks and tops into one integral unit with welds ground smooth and polished.
6. Where stainless steel tops and sinks occur with no base cabinetry provide support brackets, stretchers, and returns of 14 gauge x 41 mm outside diameter stainless steel. Brackets to be welded to 5 mm thick wall plates and stretcher at 45-degree angle. See drawings for spacing of brackets.

E. Solid Lumber Core Work Surface:

1. Provide edge grain maple top of 44 mm, hard maple strips not more than 44 mm wide, glued under heavy pressure with water resistant resin side to side and end to end. Round top edges and corners and sand smooth.
2. Supply loose curbs for field application in same thickness as countertops.
3. Apply two coats of boiled linseed oil, well rubbed into all surfaces.
4. Apply three coats of moisture and reagent resistant natural varnish finish to top and two coats to underside. Fine sand top between coats.

2.10 WALL MOUNTED AND ISLAND SHELVES

A. Brackets and Standards:

1. Type I Standards and Brackets: Standards shall be strut type channels fabricated from 16 gauge minimum cold-rolled steel. Brackets shall be 4.7 mm minimum cold-rolled steel with 13 mm

wide brace. Brackets shall have upturned lips to retain shelf. Shelf to be supported from above, with positive three-point attachment as detailed. Shelves shall be screwed to brackets. Brackets and standards shall be painted to match metal base cabinets.

2. Type II Standards and Brackets: Shelves to be supported by heavy duty Unistrut Series P-2490 brackets providing positive attachment to Unistrut P-1000 channel anchored to the wall. Brackets and channel shall be as manufactured by Unistrut Corporation, or an equal product.

B. Shelves:

1. Adjustable shelves shall be 25 mm thick veneer core plywood ~~veneers of body with exposed plastic laminate surfaces. to match wood casework components. Provide minimum 3 mm thick solid hardwood edge banding at all four sides of shelves.~~ All shelves shall be 300 mm deep unless otherwise noted on the drawings.

2.11 SINKS AND CUP SINKS

A. Cast Epoxy Resin Sinks:

1. Non-glare black epoxy, molded in one piece with surfaces smooth, corners coved and bottom sloped to outlet. Minimum physical properties and chemical resistance as specified herein for cast epoxy resin tops.
 - a. Thickness: 13mm minimum. Sink counter cutout shall overlap interior dimensions of sink by 13mm on all four sides.

B. Stainless Steel Sinks:

1. 18 gauge, Type 304, and with No. 4 satin finish. Fabricate with horizontal and vertical corners rounded and coved to at least 16 mm radius. Slope sink bottoms to pitch to outlet. Provide double wall construction for sink partitions with top edge rounded to at least 13 mm diameter. Continuous butt weld joints and provide factory punching for fixtures.
2. When stainless steel sinks are part of stainless steel tops, weld sink units to tops and finish to produce an integral unit with invisible joint line.
3. Install sink units to other than stainless steel tops with integral rim or sink ring, set in mastic or sealant to form a positive seal with top. Apply approximately 3 mm thick, heat-resistant underseal to underside of sink surfaces for condensation prevention and sound-deadening.

C. Cup Sinks at Island Benches:

1. Integrally molded from modified thermosetting non-glare black epoxy resin, specially compounded and oven cured. Conform to requirements for materials as specified for tops or sinks.

- a. 111 mm x 349 mm x 138 mm with a minimum wall thickness of 10 mm. Coved corners and bottom pitched to outlet opening. Furnish with tailpiece integral with cup sink units.

D. Cup Sinks at Fume Hoods:

1. Cast epoxy resin. Conform to requirements for materials as specified for tops or sinks.
 - a. 76 mm x 152 mm oval in fume hoods. Furnish with tailpiece integral with cup sink units.

E. Sink Schedule:

1. Refer to drawings and schedules for types, locations, and sizes of each sink.

2.12 LABORATORY PEGBOARDS AND ACCESSORIES

A. Laboratory Pegboards:

1. Pegboard shall be fabricated of 19 mm thick cast epoxy resin. Color to be non-glare black to match bench tops. White injection molded polypropylene pegs shall be 10 mm in diameter 152 mm long. Provide stainless steel drip troughs with stainless steel wire mesh screen insert, drain and 914 mm of clear plastic tubing. Trough shall be removable for cleaning.
 - a. Type 1: 760 mm long x 736 mm high.

2.13 Knee Space Aprons: Aprons to be fronts only rather than full frame type unless needed for support of countertop or integral drawer unit.

2.14 PAPER DISPENSER / CUTTER

- A. Unit designed to dispense light to heavy kraft and other papers, with spring-loaded cutting blade.
- B. Construction: 18-gauge cold rolled steel.
 1. Mounted on wall or countertop, or under counter as indicated.
 2. Provide rubber grommets for counter protection.
 3. Equip with dowel holders and knife arm that lock in open position for easy roller changing.
 4. Up to 225 mm diameter paper.
 5. White, powder coat finish.

2.15 SAFETY EQUIPMENT

- A. Safety Cabinet: Manufacturer's customized valve box designed to hold the following safety kits.

1. Construction: 14-guage stainless steel.
 - a. Inside box dimensions: 300 mm x 300 mm x 200 mm deep.
 - b. Fully recess mounted, overlapping trim, and door flush with trim, with friction roller catch.
 - c. Surface mounted door handle finished to match door.
 - d. Continuous piano hinge.
 - e. No lettering on door.
 - f. Provide 6 mm diameter holes inside box on four sides for mounting in laboratory casework.

B. First Aid Kit:

1. Product: Small light industrial first aid kit.
2. Quantity: One per safety cabinet.

C. Burn Kit:

1. Food service kit.
2. Quantity: One per safety cabinet.

2.16 MECHANICAL SERVICE FIXTURES

A. Service Fixtures:

1. Provide units complete with washers, locknuts, unions, and nipples for positive mounting to supporting laboratory units. Include wall and deck flanges, escutcheons, handle extension rods and remote valves. Factory assemble and individually test all assemblies. Fabricate units to withstand test pressure of 100 psig.
2. Finish:
 - a. For mechanical service fixtures other than those inside a fume hood, exposed surfaces including fittings and escutcheons to have bright chrome plated finish.
 - b. For fixtures inside fume hoods, coat with acid and solvent resistant baked-on plastic coating. Color to match fixture color code as indicated below.

- B. Service Outlets Identification: Provide colored plastic index discs with embossed identification letters at each service fixture handle or knob. Secure discs to fixture handles. Color code discs as follows:

<u>Service</u>	<u>Color</u>	<u>Code</u>	<u>Letter Color</u>
Air	Orange	Air	Black
Gas	Blue	Gas	White
Vacuum	Yellow	Vac	Black
Hot Water	Red	HW	White
Cold Water	Green	CW	White
Special Gas	Light Gray	SG	Black

- C. Ground Key Type Hose Cocks: Tapered core and handle of one piece forged brass with removable serrated outlet.

- D. Needle Valves: Provide units with renewable self-centering floating cones and renewable seats of stainless steel or monel metal.
- E. Water Valves or Faucets: Provide units with renewable barrel locked in valve body. Barrel shall contain all wearing parts, with renewable discs.
- F. Hand of Fixtures: Furnish right-hand fixtures unless noted otherwise.
- G. Vacuum Breakers: Provide vacuum breakers on hot and cold water fixtures. Gooseneck fixtures and hose bib fixtures shall have atmospheric type vacuum breakers.
- H. Service Fixture Schedule:
 - 1. Ground Key Outlets: Use for Air (A), Gas (G), or Vacuum (V) service as noted on drawings or as follows. Alpha-numeric designations are for drawing symbols followed by unit description.
 - a. G-1, A-1: Deck mounted round turret base with ground key cock valve with removable straight serrated hose ends.
 - b. G-2, V-2, A-2: Deck mounted round turret base with two ground key cock valves with removable straight serrated hose ends. Outlets at 180 degrees to each other.
 - c. A-7: Panel mounted flange with single key cock valve and removable serrated hose end.
 - 2. Remote Operated Outlets: Use for Gas (G), Air (A) or Vacuum (V) service as noted on drawings or as follows. Alpha-numeric designations are for drawing symbols followed by unit description.
 - a. G-31, A-31, V-31: Remote control assembly with remote needle valve, handle, wall mounted, angled serrated outlet.
 - 3. Needle valve Outlets: Use for Specialty Gas (SG) and Air (A) service as noted on drawings or as follows. Provide brass four blade handles. Plastic handles are not acceptable.
 - a. SG-31: Remote control assembly with remote needle valve, handle, wall mounted, angled serrated outlet.
 - b. A-6: Deck mounted turret with straight pattern laboratory fine control needle valve with pressure regulator and quick connect fitting.
 - c. A-8: Panel mounted with angle pattern laboratory fine control needle valve with pressure regulator and quick connect fitting.
 - 4. Hot and Cold Water Mixing Outlets: Use for mixing of hot and cold water (HCW) as noted on drawings or as follows. Numbers are for drawing symbols, followed by unit description.
 - a. HCW-1: Vacuum breaker 305 mm swing gooseneck and Aerator fitting. Panel mount 102 mm wrist blade lever handles with shank assembly.

- b. HCW-2: Vacuum breaker 203 mm swing gooseneck and aerator fitting. Deck mount 102 mm wrist blade lever handles.
 - c. HCW-6: Panel mounted pre-rinse assembly with spring action type gooseneck, self-closing valve with insulated handle and rubber bound spray head.
 - d. HCW-7: Service sink faucet with 152 mm rigid vacuum breaker spout, wall support and aerator fitting. Wall mounted 102 mm wrist blade lever handles. Rough chrome plated finish.
5. Single Service Water Outlets: Use for single service outlets for Cold Water (CW) as noted on drawings and as follows. Alpha-numeric designations are for drawing symbols followed by unit description.
- a. CW-1: Remote control water valve with panel mounted turret base with 152 mm swing gooseneck and mounting shank with aerator.
 - b. CW-2: Rigid union coupling gooseneck, removable serrated outlet, deck mounted. Hand of valve will vary with location. Coordinate with plans.
6. ~~Eye Wash~~ Eye Wash & Deluge Hose: Use for deck mounted or panel mounted eye washes (EW) as noted on drawings or as follows. Alpha-numeric designations are for drawing symbols followed by unit description.
- a. EW-1: Chrome plated with dual soft stream heads operated by a self-closing squeeze lever valve with locking clip and stainless steel dust cover. Provide 2438 mm long high-pressure hose with flange and handle guide for mounting eyewash to countertop.
 - b. EW-2: Chrome plated with dual soft stream heads operated by a self-closing squeeze lever valve with locking clip and stainless steel dust cover. Provide 2438 mm long high-pressure hose with flange and handle guide for mounting eyewash through vertical panel.
7. Combination Safety Shower / Eyewash Unit: Use for combination safety shower and eyewash unit (SS/EW) as noted on drawings and as follows. Alpha-numeric designations are for drawing symbols followed by unit description.
- a. SS/EW-1: Barrier-free, swing down eye/face wash and shower actuation valve in a recessed stainless steel cabinet. Provide deluge type emergency shower with a pull-on, pull-off control valve, chrome plated polished shower head and elbow, and polished chrome plated brass nipple and escutcheon at wall.

2.17 ELECTRICAL SERVICE FIXTURE

- A. Electrical Raceway in Reagent Shelf System. As shown on drawings, electrical raceway is mounted horizontally along shelf uprights. Casework Manufacturer will provide all parts necessary to integrate electrical raceway into the shelving system, including electronic devices, and stainless steel face plates. See Division 16 for electrical requirements, including device colors and materials.
- B. Electrical Pedestal: Deck mounted electrical pedestal as noted on the drawings or as follows. Casework Manufacturer will provide all parts necessary to deck mount electrical box including electrical devices, mounting shank, and stainless steel face plates. See Division 16 for electrical requirements, including device colors and materials. Alphanumeric designations are for drawing symbols followed by unit description.
 - 1. E-1: Double gang, double face polished aluminum electrical box with stainless steel face plate.

2.18 UMBILICALS

- A. Umbilicals shall be furnished and installed in the configurations and locations indicated on the drawings and as detailed and specified herein:
 - 1. Umbilical sections shall be constructed of 18 gauge sheet metal with collar at top and bottom. Bottom collar shall be same material as bench top, popery glued or cemented to top as detailed. Top collar shall be 16 gauge sheet steel.
 - 2. Umbilical shall have removable sections as detailed for easy access to piping and conduit. Removal of sections shall not disturb the ceiling or bench top.
 - 3. On freestanding umbilical there shall be a channel spot-welded to the fixed enclosure section at third points of unsupported length.
 - 4. Finishes shall conform to steel cabinet finish of this section with color selected by the Architect.

2.19 EXAM ISLAND BENCHES

- A. Four Leg Adjustable Height Tables:
 - 1. Nominal base dimensions:
 - a. Width: As shown on drawings.
 - b. Depth: As shown on drawings.
 - c. Height range: 711 mm to 949 mm.
 - 2. Freestanding table capable of supporting suspended base cabinets.
 - 3. Table equipped with levelers or casters, as indicated on the drawings.
 - 4. Outer leg: 11-gauge rolled steel C-channel.
 - 5. Inner telescoping leg: 16-gauge rolled steel rectangular tubing.
 - 6. Adjustment mechanism: Mechanical with locking bolts.
 - 7. Weight capacity:

- a. Levelers: 450kg.
- b. Casters: 157kg.

2.20 INSTRUMENT CARTS

A. General Requirements:

1. Provide Types and lengths shown on the drawings.
 - a. Type 1: 1200 mm wide and 1500 mm wide by 775 mm deep work surface, and two tiers of 300 mm deep upper shelves.
 - b. Type 2: Same unit as above, without upper shelves.
2. Riser uprights: 16 gauge cold rolled steel.
3. Riser uprights to have an upper and lower portion connected together with an internal connecting device and no external fasteners. Upper riser portion can be removed and lower portion functionality is not to be affected.
4. Vertical upright: notched for 25 mm adjustment of components supported off riser upright.
5. Cart base: 51 mm x 76 mm, 11 gauge steel rectangular tubing welded together.
6. Casters: Provide (4) 76 mm diameter wheels with self-lubricating bearings, rated to carry 160 kg minimum, each. Each caster must swivel and have a locking brake.
7. End caps: ABS plastic, color matched.
8. Finish: Chemical resistant powder coat paint finish, as specified under Metal Finishes.
9. The maximum total load rating of unit is 400 kg.
10. The overall height of the cart is 2032 mm maximum, length 1854 mm, and the depth is 762 mm with upper portion of the uprights attached. If the upper portion of the upright is removed, the overall height is 914 mm.
11. Cart must be able to be tipped 10 degrees in any direction with no accessories attached and be able to right itself to its upright position.
12. The 1828 mm cart must provide for two 914 mm long independently adjustable work surfaces and shelving options.

2.21 FLEXIBLE WORK STATIONS

- A. Modular dimensioned system of core and panel style support structures, and portable tables.
- B. Panels: Support structures for tables, storage units and shelves.
 1. Modular units shall be suitable for wall, peninsula or island configurations.
 2. Panels supported with adjoining perpendicular panels or structural tables or base units.
 3. Equipped with easy to remove access panels with integral fasteners.

- C. Wall Rail: Wall attached support structure for tables, storage units and shelves, and component accessories. Modular dimensioned system of 32 mm wide x 25 mm deep wall rail style support structures.
 - 1. Modular units shall be suitable for wall, peninsula or island configurations.
 - 2. Slotted Vertical Rails supported by horizontal channels bolted to wall structure.
 - 3. Equip with easy to remove insert panels.
- D. Modular System Requirements:
 - 1. Independently supported work surfaces, undercounter cabinets, and overhead storage components.
 - 2. Structural components that are essentially self supporting and independent of the building structure.
 - 3. Core type support structures supporting cupsinks, service fittings, fixtures, and supply and waste lines using commercially available pipe clamps.
 - 4. Cabinet fastening devices that cannot be accidentally released from framing system. Intentional release shall be easily accomplished without disturbing the cabinet contents by simply loosening two bolts.
 - 5. Core access panels featuring integral snap-on "hook and loop" fasteners for quick, easy access to service chase area. All access panels shall be removable even when cabinets are directly in front of the panel.
 - 6. Suspended base cabinets removable without removal of the work surface.
 - 7. Wall cabinets shall be adjustable vertically and laterally and removable without the use of tools.
 - 8. Suspended base cabinets capable of being relocated while fully loaded and installed in any position between table legs.
 - 9. Vertical height of table work surfaces, wall cases and shelves can be adjusted with simple, but positive mechanisms.

2.22 INDEPENDENTLY SUPPORTED WORK SURFACES AT FLEXIBLE WORK STATIONS

- A. General Requirements:
 - 1. Modular, interchangeable work surface support structures in both fixed height and adjustable height configurations.
 - 2. Adjustable height tables include cantilever and four-leg mechanical adjustment.
 - 3. Fixed height tables include two-leg, structural and extended frame configurations.
 - 4. Provide caster and leveler options on both fixed height and adjustable height tables, where indicated.
- B. Table Construction:
 - 1. Work surface support frame: 11 gauge cold rolled steel tubing. Cabinet support channels: 14 gauge cold rolled steel. Weld members using the inert gas process.
 - 2. Support arms:

- a. Cantilever support arms: 11 gauge cold rolled steel.
- b. 4 leg adjustable height support arms: 11 gauge rolled steel.
3. End caps: Flame resistant ABS plastic, color matched.
4. Finish: Chemical resistant powder coat paint finish in manufacturer's standard color to be selected.

C. Cantilever Table Frame:

1. Nominal table frame dimensions:
 - a. Width: As shown on drawings.
 - b. Depth: As shown on drawings.
 - c. Height: 508 mm.
2. Capable of vertical adjustment in 25 mm increments.
3. Hanging hook: Five support fingers of 11 gauge cold rolled steel.
4. Leveling /locking stud: Provide in leg member and design to engage the upright and provide a positive means of locking the cantilever table frame to the upright. Stud shall be capable of raising front edge of the work surface 2 mm - 2.5 mm for leveling purposes.
5. Cantilever table frame shall provide support channels from which suspended cabinets can be hung and adjusted horizontally.
6. Total width of suspended cabinets must be less than the table width to allow for clearance for table frame uprights on 610 mm deep table frames.
7. Weight capacity: Work surface plus 270 kg.

D. Structural Table Base:

1. Nominal base dimensions:
 - a. Width: As shown on drawings.
 - b. Depth: As shown on drawings.
 - c. Height: As shown on drawings.
2. Capable of attaching to and providing support for cores and panels.
3. Leg members shall have two finger locking hooks.
4. Base unit shall provide support channels from which suspended cabinets can be hung and adjusted horizontally.
 - a. 736 mm deep bases shall allow suspended cabinets to be hung directly in front of the leg member for complete cabinet utilization; 1219 mm suspended cabinet hanging from 1219 mm add-on table base.
 - b. 736 mm deep bases shall allow cabinets to straddle leg members, resulting in suspended cabinets hanging from two adjacent table bases.
 - c. 584 mm deep bases shall allow cabinet to be hung only between table arm supports.
5. Weight capacity: Work surface plus 6270 kg.

2.23 SUPPORT STRUCTURES - WALL PANELS

A. General requirements for cores and panel type support structures:

1. Riser uprights: 16 gauge rolled steel supplied with leveling guides.
2. Frames: Rolled steel, resistance welded. Frame members and tie rail brackets: 16 gauge; corner gussets: 14 gauge.
3. Tie rails: 16 gauge cold rolled steel.
4. Base cover: 18 gauge cold rolled steel.
5. Slotted adjustment punched into riser upright.
 - a. Notched for 25 mm adjustment of components supported off riser upright.
6. Riser cap: Flame resistant ABS plastic, color matched.
7. Closure panels: 20 gauge cold rolled steel.
8. Closure panel fasteners: "Dual-lock".
9. Adjustable floor clamps: Two per core or frame; 80-55-06 ductile cast-iron.
10. Plug caps: ABS flame retardant plastic, color matched.

B. Island Panels:

1. Nominal dimensions:
 - a. Width: As shown on drawings.
 - b. Depth: 83 mm.
 - c. Height of lower panels: 900 mm.
 - d. Height of upper panels: 1200 mm.
 - e. Full height panels: 2100 mm.
2. Upper and lower panels shall be of the same materials and construction.
3. Lower panel shall be capable of having upper panel removable.
4. Lower panel shall be capable of having upper panel added after installation.
5. Components, such as cantilever table frames and shelves supported off upper and lower panels, shall be vertically adjustable in 25 mm increments.
6. Closure panels for upper and lower panels shall snap on without tools and shall be removable without removal of cantilever table frames or suspended cabinetry.
7. Installed 2100 mm high island panels shall support following components and loads:
 - a. Outside shelves or wall cases, each loaded to maximum capacity.
 - b. Two cantilever work surfaces, each loaded with 180 kg; or two structural tables, each loaded with 270 kg.

C. Wall Panels:

1. Nominal dimensions:
 - a. Width: As shown on drawings.

- b. Depth: 83 mm.
 - c. Height: As shown on drawings.
- 2. Cross rails and cross rail brackets: 16 gauge cold rolled steel, resistance welded.
- 3. Panels shall be designed so electrical services can be run from one frame to the next.
- 4. Panels, when secured to wall and floor, shall be capable of supporting worst-case loading conditions without end riggers.
- 5. Hanging components, such as cantilever table frames and shelves, shall be vertically adjustable in 25 mm increments.
- 6. Installed 2100 mm high panel shall support following components, each loaded to its maximum rating for a total of 205 kg.
 - a. Three outside shelves or wall cases.
 - b. One cantilever work surface.

2.24 SUPPORT STRUCTURES - WALL RAIL TYPE

A. Wall Rail System:

- 1. Horizontal Vertical Rails: Cold rolled 11-gauge steel, slotted vertical, notched for 25 mm adjustment of components.
- 2. Horizontal Frames: Cold rolled steel, 11-gauge slotted for 150 mm adjustment of vertical rails.
- 3. Base cover: 18 gauge cold rolled steel.
- 4. Insert panels: 20 gauge cold rolled steel or optional fabric covered tackboard.

B. Wall Rails:

- 1. Nominal dimensions:
 - a. Width: Single slotted 38 mm; double slotted 76 mm.
 - b. Depth: 25 mm.
 - c. Height: 900 mm; 2100 mm.
- 2. Horizontal cross rails: 14 gauge cold rolled steel.
- 3. Rail, when secured to wall, shall be capable of supporting worst-case loading conditions.
- 4. Hanging components, such as cantilever table frames and shelves, shall be vertically adjustable in 25 mm increments.
- 5. Closure panels shall be inserted without tools and shall be removable without removal of cantilever table frames or suspended cabinetry.
- 6. Installed 2100 mm high rails shall support following components, each loaded to its maximum rating:
 - a. Outside shelves.
 - b. Wall cases.
 - c. One cantilever work surface.

2.25 SHELVES

A. General requirements for shelves:

1. Shelves, hat channel supports, and separate shelf lip: 18 gauge rolled steel.
2. Shelf brackets: 11 gauge rolled steel.
3. Vertical shelf adjustment: 25 mm increments.
4. Depth and weight capacity:
 - a. 152 mm = 82 kg.
 - b. 203 mm = 82 kg.
 - c. 305 mm = 82 kg.
 - d. 457 mm = 53 kg.
 - e. 610 mm = 45 kg.

B. Outside Shelf:

1. Nominal dimensions:
 - a. Length: As shown on drawings.
 - b. Depth: As shown on drawings.
2. Shelf shall be capable of being locked into position.
3. Shelf brackets shall rise above the shelf surface to provide sides.

2.26 MODULAR FURNITURE BASE AND WALL CABINETS FOR ADJUSTABLE WORK STATIONS

- A. Design requirements, performance requirements, materials, fabrication and hardware shall comply in all respects with fixed wood and/or steel casework specifications in this section.
- B. Suspended cabinet hardware: Provide a system of steel C-channels and brackets attached to the casework frames, enabling the installation and removal of suspended base cabinets without the use of special tools.
- C. Suspended wall case hardware: Provide a system of steel hanger rails attached to the casework frames, to be vertically adjustable on 25 mm increments. Installation and removal of suspended wall cases to be accomplished without the use of tools.

2.27 MODULAR SYSTEM FOR COMPUTER CRIME ROOM 805 (SUPPORT STRUCTURES)

A. Product Characteristics:

1. Nominal dimensions:
 - a. Height: 1956 mm with levelers; 2032 mm with caster kit.
 - b. Depth: 768 mm.
 - c. Widths: As shown on drawings.
2. 768 mm vertical leg members shall be capable of supporting 675 kg with minimal deflection with integral welded support foot and leveler.

3. Uprights shall be double slotted in 25 mm increments for maximum height adjustability of components. Leg members designed to serve as either an end leg or intermediate leg in an assembly.
4. Horizontal cross rails capable of expanding or resizing a work station assembly by a simple attachment mechanism to the vertical member.
5. Cross rails shall be available in seven standard widths from 609 mm to 2438 mm. With the addition of the intermediate upright, increase load capacity to 1025 kg.
6. Both horizontal and vertical support structures shall incorporate an integral nonconductive cable management system that shall be factory attached and shipped as a complete unit. Channels shall mount behind frames, shelves, and work surfaces and shall include an integral snap-lock channel cover.
7. Horizontal cross rails vertically slotted to accept the intermediate center upright support to allow subdivision of the frame assembly at various widths and capable to resizing an existing assembly according to the needs of changing personnel and equipment.
8. Intermediate center upright support shall attach to the lower and upper cross rails and shall subdivide 1219 mm through 2438 mm wide assemblies to accommodate interchangeable components of various widths and sizes.
9. Vertical support leg member shall be capable of accepting interchangeable leveling glides or locking casters. Levelers shall support 270 kg each; casters shall support 168 kg each.
10. Hanging components, such as cantilevered table frames, flipper door modules, and shelves, shall be vertically adjustable in 25 mm increments.
11. Optional rack mount adapter kits:
 - a. Mount 483 mm and 635 mm wide rack mountable components in the vertical leg member slot.
 - b. 762 mm wide assemblies that can be converted to 610 mm wide rack mounts.
 - c. 610 mm wide assemblies that can be converted to 483 mm wide rack mounts.
12. Installed 2438 mm wide assemblies shall support a maximum rating for a total of 1025 kg, evenly balanced cantilevered on one side.

B. Work Surfaces:

1. Nominal dimensions:
 - a. Width: As shown on drawings.
 - b. Depth: As shown on drawings.
2. Cantilevered work surfaces:
 - a. Hard plastic laminate top surface and edge banding, covered on bottom with backer sheet to prevent warpage;
 - b. Core: 25 mm thick, 21 kg density particleboard.
3. Work surfaces capable of vertical adjustment on 25 mm increments.

4. Locking /leveling stud shall be provided in leg member and designed to engage the upright and provide a positive means of locking the cantilever support to the upright, preventing accidental disengagement. Leveling stud shall be capable of raising the front edge of the work surface 4 mm for leveling purposes.
5. Cantilevered work surface support arms of cold-rolled steel capable of supporting 130 kg, evenly balanced.
6. Cantilevered work surface table frames:
 - a. Cold-rolled steel capable of supporting 270 kg, evenly balanced. Table frames shall also support optional under-counter suspended storage cabinets.
7. Hanger hooks of cold-rolled steel with five support fingers that positively engage the vertical leg member.

C. Shelves:

1. Nominal dimensions:
 - a. Widths: As shown on drawings.
 - b. Depth: As shown on drawings.
2. Shelf height adjustable 25 mm increments and relocatable without the use of tools for ease of adaptability.
3. Tilt shelves shall be capable of being locked into position.
4. Shelf brackets shall rise above the shelf surface to provide containment at sides of the shelf unit.
5. Where indicated, fixed shelves shall have an integral full-length safety lip to prevent forward slippage of stored equipment.
6. Tilt shelves shall offer an ergonomic solution to support monitors and keyboard equipment. Shelves that can be fixed at 0, 5, 10 and 15 degrees for personal and equipment requirements.
7. Corner shelves shall engage three vertical upright leg members for maximum live-load capacity and use of available vertical space.
8. Server shelves shall incorporate an integral cable management armature and shall be mobile to gain accessibility to both side and back to servicing and equipment upgrades.
9. Depth and weight capacity of both fixed and tiltable shelves without deflection:
 - a. 300 mm, 457 mm, and 610 mm: 375 kg.
 - b. Corner shelf: 120 kg.
 - c. Server shelf: 375 kg.

D. Keyboard Trays:

1. Keyboard trays mounted conveniently under work surfaces and/or shelves to support keyboards and optimize accessibility and space by storing under counter when not in use. Mouse pad fully integrated into all-in-one keyboard assembly.

PART 3 - EXECUTION

3.1 CASEWORK INSTALLATION

- A. Install plumb, level, true and aligned with no distortions. Shim, using concealed shims. Where laboratory casework abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed. Fit scribe strips to irregularities of adjacent surfaces. Maximum gap opening shall be 0.8 mm.
- B. Base Cabinets: Set cabinets straight, plumb, and level. Adjust sub-tops within 1 mm of a single plane. Bolt continuous cabinets together. Fasten continuous cabinets to floor at toe space, with fasteners spaced 610 mm O.C. Secure individual cabinets with not less than two fasteners into floor, where they do not adjoin other cabinets. Assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1 mm.
- C. Wall Cabinets and Shelves: Fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified herein for base cabinets. Reinforcement of stud walls to support wall-mounted cabinets and shelves shall be done during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this work.
- D. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises unless otherwise indicated. Turn screws to flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.
- E. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.2 INSTALLATION OF TOPS

- A. General:
 - 1. Field Jointing: Make in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no job site processing of top and edge surfaces.
- B. Cast Epoxy Resin Tops:
 - 1. Fastening: Secure to cabinets with silicone adhesive applied at each corner and along perimeter edges at not more than 1219 mm O.C. Adhesive rather than epoxy cement is to allow for future disassembly and relocation.
 - 2. Workmanship: Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection. Provide flush hairline joints in top units using clamping devices.
 - 3. Tolerances: Provide joint widths not more than 1 mm wide, filled and flush with abutting edges. Horizontal alignment of top

surface of all joints for their entire length shall be within 0.8 mm. Front edges of all abutting pieces shall align.

4. Surface Finish: After installation, dress joints smooth, remove surface scratches, clean, and polish entire surface.
5. Verify field dimensions and squareness of adjacent walls prior to installation.

3.3 INSTALLATION OF SINKS

- A. Underside Installation: Use manufacturer's recommended adjustable support system for table-type and cabinet-type installations. Set top edge of sink unit pressed to countertop, set in manufacturer's recommended chemical resistant sealing compound to produce a tight and fully leak-proof joint. Adjust sink and support to prevent movement. Remove excess sealing compound once sink is set.
- B. Semi-Flush Installation: Use stainless steel sink frame, complete with clamping lugs and pads. Before setting, apply a full coat of manufacturer's recommended sealant under rim lip and along top. Omit sink frame if sink is fabricated with an integral rim seal.

3.4 INSTALLATION OF ACCESSORIES

- A. Install in a precise manner in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.

3.5 SITE CLEAN-UP

- A. Procedure: It shall be the responsibility of the casework contractor to remove his own packaging debris and other waste resulting from installation to the common disposal area on site.

3.6 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as directed by the Architect upon completion of installation.
- B. Clean shop-finished surfaces, touch-up and remove or refinish damaged or soiled areas, as acceptable to Architect. Clean and polish all epoxy resin countertops with a product specifically intended for this purpose.
- C. Protection: Protect materials and installed laboratory casework and fixtures from damage by work of other trades.

END OF SECTION 12350

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SECTION 12490A

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-- End of Section Table of Contents --

SECTION 12490A

WINDOW TREATMENT

PART 1 WORK DESCRIPTION

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS AA-V-00200 (Rev B) Venetian Blinds

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996; Errata 96-4) National Electrical Code

NFPA 701 (1996) Methods of Fire Tests for Flame-Resistant Textiles and Films

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G A/E

Drawings showing fabrication and installation details. Drawings shall show layout and locations of track, direction of draw, mounting heights, and details.

SD-03 Product Data

Window Treatments; G A/E
Hardware; G A/E

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Samples

Window Treatments

Three samples of each type and color of window treatment. Blind slats or louvers shall be 150 mm in length for each color. Track shall be 150 mm in length. Shade material shall be minimum 150 x 150 mm in size.

SD-10 Operation and Maintenance Data

Window Treatments

1.3 GENERAL

Window treatments shall be provided, complete with necessary brackets, fittings, and hardware. Each window treatment type shall be a complete unit provided at locations shown on the drawings. Equipment shall be mounted and operated as indicated. Windows to receive a treatment shall be completely covered. The Contractor shall take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling. Materials shall be stored flat in a clean dry area with temperature maintained above 10 degrees C.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 WINDOW BLINDS

Each blind, including hardware, accessory items, mounting brackets and fastenings, shall be provided as a complete unit produced by one manufacturer. All parts shall be one color unless otherwise shown, and match the color of the blind slat. Steel features shall be treated for corrosion resistance.

2.1.1 Vertical Louver Blinds

Vertical louver blinds consisting of equally spaced, synchronized louver vanes and rail system with self-aligning carrier mechanisms, carriers, traverse and vane directional mechanisms and controls, and installation hardware. Provide vertical louver blinds with headrail system of anodized, extruded aluminum with long edges returned or rolled, and channel-shaped, enclosing operating mechanisms. Wheeled carriers shall consist of engineered plastic with self-lubricating wheels. Color shall be as selected by Architect from manufacturer's standard color range.

2.1.1.1 Louver Vanes

Louver Vanes shall be lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC that will not crack or yellow; with flat profile and not less than 9.5 mm overlap when vanes are rotated fully closed. Nominal vane width shall be 125 mm. Vane directional and traversing control shall be by motorized operator. Provide one-way controls and stack left or right. Cord tensioner shall be sill mounted. Valance shall consist of one vane insert in color to match the louver vanes.

2.1.1.2 Louver Bottoms

Louver bottoms shall have connecting or spacing chains. Provide ceiling mounted blinds permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind. Stack release to permit stacked vanes to be moved away from stacking position for total access to glazed opening. Colors shall be as selected by Architect from manufacturer's full range.

2.2 MOTORIZED VERTICAL LOUVER BLIND OPERATORS

Provide factory-assembled blind operation systems designed for blind type, size, weight, construction, use, and operation frequency indicated, with traverse and rotation functions. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for project conditions and recommended by blind manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, power disconnect switches, enclosures protecting controls and all operating parts, headrail, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system. Comply with NFPA 70. Control equipment shall comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

2.2.1 Electric Motors

Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal overload protection and internal limit switches; sized by blind manufacturer to start and operate size and weight of blind considering service factor or considering project's service conditions without exceeding nameplate ratings. Motor mounting shall be as recommended by manufacturer for the application.

2.2.2 Remote Controls

Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush within headrail mounting. Provide the following devices for remote-control activation of blinds:

1. Control Stations: Momentary-contact, three-position, toggle-style, wall switch-operated control station with open, close, and center off functions.

- a. Color: White.

2. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop blind at fully traversed, rotated closed and fully retracted, rotated open positions.

2.3 ROLLER SHADES

2.3.1 Product Description

Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

2.3.2 Audiovisual Light-Blocking Shades

Audiovisual light-blocking shades designed for eliminating all visible light gaps when shades are fully closed; fabricated from blackout shade band material with fascia, headbox, pocket, and bottom bar extended and formed for light-tight joints among shade components and between shade components and adjacent construction.

1. Shade band material shall be PVC-coated fiberglass, in color to be selected by Architect from manufacturer's full range.

2.3.2.1 Side Channels and Perimeter Seals

Side Channels and Perimeter Seals shall be manufacturer's standard design, including sill light seal attached to bottom bar, for eliminating light gaps when shades are closed. Shade band retention system shall be manufacturer's standard design for guiding shade band material through range of travel and holding shade band flat with edges of material within side channels.

2.3.2.2 Shade Operation

Shade Operation shall be manual with spring roller lift operator. Provide manufacturer's standard hand grip engaged pull.

2.3.2.3 Rollers

Electrogalvanized or epoxy primed steel or extruded-aluminum tube of

diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Provide capacity for one roller shade band per roller, unless otherwise indicated on Drawings. Mounting brackets shall be galvanized or zinc-plated steel.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window treatments shall be adjusted for form and appearance, shall be in proper operating condition, and shall be free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

-- End of Section --

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SECTION 12491

CURTAINS AND DRAPES (BLACK OUT DRAPES)

09/99

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-- End of Section Table of Contents --

SECTION 12491

CURTAINS AND DRAPES (BLACK OUT DRAPES)

09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (1996) Fire Tests for Flame-Resistant
Textiles and Films

UNDERWRITERS LABORATORIES (UL)

UL 214 (1997) Flame-Propagation of Fabrics and
Films

1.2 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-04 Samples

Drapery fabric; G A/E

Submit a range of three samples, 900 by 900 mm or larger, to match the fabric quality, weight, pattern, and color shown or specified.

Once selected, label approved samples to identify locations for their use in the project. Maintain identification and approval markings until final acceptance of the work.

SD-06 Test Reports

Flame resistance

SD-10 Operation and Maintenance Data

Drapery system, Data Package 1

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver draperies to the site in sealed containers clearly labeled with manufacturer's name and contents. Store in a safe, dry, clean, and well ventilated area. Do not open containers until needed for installation, unless verification inspection is required.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Fabrics

2.1.1.1 Drapery Fabric

Provide blackout curtains similar to 6116DP fabric as manufactured by Regal Photo Products, Inc.

Provide fabric manufactured of 100 percent laminated vinyl composition. Fabric shall be flame resistant, light tight, fade resistant, dimensionally stable and provide low smoke generation. Fabric physical characteristics shall be as follows:

- a. Finished fabric weight: 18 oz/sy.
- b. Pattern: None.
- c. Texture: Smooth.
- d. Color: Black.

2.1.1.2 Flame Resistance

UL 214 or NFPA 701. Drapery fabric and lining shall pass the small and large scale test. Treatment to enhance flame resistance shall be permanent type. If treated, fabric shall pass the small and large scale test after being subjected to the accelerated dry cleaning or laundering cycles specified in UL 214 or NFPA 701.

2.1.2 Sewing Thread

Pre-shrunk mercerized cotton (50/3) or monofilament in equivalent size, except do not use monofilament in the heading.

2.1.3 Metal Grommets

Rust proof metal grommets shall be set 13 mm below top edge and spaced 125 mm on center. The bottom and both outside edges of the curtain shall be a selvaged edge.

2.1.4 Drapery Hardware

Provide track system specified in Section "Cubicle Track and Hardware."
Provide one manufacturer's design throughout.

2.2 FABRICATION

Prior to cutting and fabrication, field measure each drapery location paying particular attention to field conditions affecting the work. Add 10 percent fullness to the width of the drapes.

2.2.1 Drapery Fabrication

2.2.1.1 Panels

Make from full or half widths of fabric. Draperies shall be full length, floor to ceiling. Floor length draperies shall hang 25 mm above finish floor. Cut fabric to allow outside ends to return to the walls. For traverse draperies, allow for a minimum overlap of 75 mm at the center. Accurately match patterned fabrics to provide identical designs horizontally and vertically within each room. When fabricating panels from fabrics which require special methods or instructions, conform to the workroom instructions provided by the fabric manufacturer. Sew seams and hems using a firm interlocking stitch at a stitch rate per millimeter appropriate to fabric being sewn. Sew with enough slack present so that thread shrinkage due to laundering and dry cleaning will not pucker seams and hems. Do not expose seam and hem raw edges.

2.2.1.2 Seams

Manufacturer's standard for the length and height drapes indicated.

2.2.1.3 Hems

Double fold hems (top and bottom) and blind stitch so as not to show on the panel face. Make side seams 38 mm wide and bottom seams 50 mm deep with flexible flat leaded weight strips sewn 13 mm above hem bottom.

PART 3 EXECUTION

3.1 EXAMINATION

Ensure that work of other trades and cleaning operations are completed.

3.2 INSTALLATION

Install draperies in rooms and areas indicated. Include all material indicated, specified, or necessary for a complete finished drapery installation. Contractor shall be responsible for the required quantities of draperies and hardware.

3.2.1 Draperies

Install with a minimum clearance of 6 mm between the ceiling and top of drapery. Floor length draperies shall hang 25 mm above finished floors. Dress-down and adjust hung draperies to provide best form and appearance. Traverse draperies shall operate smoothly and easily over the full range of travel. Remove incorrectly sized drapery and remake to correct size. Remove damaged, spotted, or otherwise defective fabric and repair to original state or replace with new material.

-- End of Section --

SECTION 13038

COLD-STORAGE ROOMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section includes the fabrication and installation of walk-in cold rooms of the prefabricated panel type. Related mechanical and electrical service fixtures are to be provided internally pre-wired and pre-piped under this Section. Connection to building rough in is by Divisions 15 and 16. Electrical service fixtures are to be GFCI protected. Provide rough-ins for security hardware and alarms by others. Refer to security drawings and door hardware sets for types of devices requiring factory or field preparation.
- B. The locations, sizes and types of cold rooms are shown on the drawings. Provide the following types:
 - 1. Walk-in cold rooms.
 - 2. Shelving.
- C. Section includes:
 - 1. Responsibility for coordination of materials, products, sequencing and installation of Work by Others with respect to the cold rooms.
- D. Related Sections:
 - 1. Division 3 Section "Cast-In-Place Concrete" and drawings for slab depressions.
 - 2. Division 7 Section "Joint Sealing."
 - 3. Wire Mesh Partitions: Division 5 "Miscellaneous Metal."
 - 4. Fire protection devices and alarms: Division 13.
 - 5. Electrical components connections: Division 16.

1.2 QUALITY ASSURANCE

- A. Manufacturer shall have an established organization and production facilities specializing in the type of equipment specified herein. The manufacturer shall have demonstrated the ability to produce the specified equipment of the highest quality and a proven capacity to complete an installation of this size and type within the required time limits. The manufacturer shall also have engineering, production, and service departments experienced in the design, fabrication, installation, and servicing of equipment specified herein.
- B. Reference standards including and/or implied, but not limited to:
 - 1. Air Conditioning and Refrigeration Institute (ARI).

2. American National Standards Institute (ANSI).
3. American Society for Testing & Materials (ASTM).
4. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).
5. Americans with Disabilities Act (ADA).
6. Factory Mutual (FM).
7. National Electrical Code (NEC).
8. National Sanitation Foundation (NSF).
9. Occupational Safety & Health Administration (OSHA).
10. Underwriters Laboratory (UL).
11. United States Department of Agriculture (USDA).
12. United States Food and Drug Administration Current Good Manufacturing Practices (FDA CGMP).
13. When provisions of pertinent codes and standards conflict with these specifications, the more stringent provisions shall govern.

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01330 "Submittal Procedures."
- B. Manufacturer shall submit complete design information for the cold rooms. This information shall include cooling equipment sizes, equipment capacities, air delivery systems, and humidity ranges.
- C. Manufacturer shall submit a listing of at least 20 projects that are comparable to this installation that have been completed in the last five years.
- D. SD-02 Shop Drawings:
 1. Cold-Storage Rooms; G, A/E.
 2. Submit shop drawings in for all rooms to be furnished, identified by Room Number and Item Number as shown on the drawings.
 3. Shop drawings shall indicate panel identification corresponding to system for numbering panels for erection. Drawings submitted must be those actually used by field personnel for erection of insulated room.
 4. Shop drawings shall indicate all features of the unit including but not limited to the following: Panels, refrigeration equipment, controls, switches, locks, doors, light fixtures, recorders, utility connection points, signage, and closure trim. Items shall be dimensioned for both size and location. Shop drawings shall indicate work to be provided by others. Contractor to coordinate services with mechanical, electrical, and other subcontractors.
- E. SD-03 Product Data:
 1. Cold-Storage Rooms; G, A/E.
 2. Refrigeration Equipment; G, A/E.
- F. SD-04 Color samples: Submit manufacturer's standard color samples.
 1. Submit two samples of panel interior and exterior finish; G, A/E.

G. SD-06 Test Reports:

1. Start up and initial operational tests; G, A/E.
2. Testing Plan: Submit testing plan to demonstrate how testing will accurately record units ability to comply with specified temperature range and uniformity. Submit test results from factory and field testing for approval.

H. SD-08 Manufacturer's Instructions:

1. Cold-Storage Rooms; G, A/E.
2. Refrigeration Equipment; G, A/E.
3. Include equipment start-up and initial operation. Include evacuation and charging procedures for refrigeration equipment.

I. SD-10 Operation and Maintenance Data:

1. Cold-Storage Rooms; G, A/E.
2. Refrigeration Equipment; G, A/E.

J. SD-11 Closeout Submittals:

1. Posted operation instructions for refrigeration equipment.

1.4 DELIVERY AND STORAGE

- A. Deliver, store and handle materials in manner to prevent damage and deterioration. Protect all factory finished panel surfaces subject to damage while in transit and after installation.
- B. Do not deliver materials or assemblies to site until installation spaces are ready to receive rooms.

1.5 SITE CONDITIONS

- A. The installing contractor shall examine and verify project conditions at the site to assure acceptable access, dimensions, and general conditions. Notify Contracting Officer in writing of conditions that are unacceptable to the installation of cold storage rooms.

1.6 SEQUENCING AND SCHEDULING

- A. Install and complete rooms in close coordination with Contractor, and with the work of other trades.

1.7 WARRANTY

- A. Manufacturer shall provide written warranty to the Owner stating the product is free from defects in material and workmanship under normal use and service. Warranty shall become effective on the date of final acceptance. The warranty shall cover the following items for the noted duration:

1. Insulated Panels: Ten years.
 2. Refrigeration Equipment: Five years.
 3. Parts and Labor: One year.
- B. Warranty will specifically guarantee in written form that one year after the date of final acceptance, the Cold-Storage Rooms will, under normal operation:
1. Maintain within the specified tolerance the selected temperature and humidity settings.
 2. Be free from sweat on the outside of the room.
 3. Be free from defects due to faulty materials or workmanship.

PART 2 - PRODUCTS

2.1 WALK-IN COLD ROOMS

- A. Chamber Construction:
1. Room size depends on wall panel module of selected manufacturer. Overall outside dimensions as indicated on the drawings.
 2. Room height: 2850 mm.
 3. Interior finish: White stucco patterned galvanized steel.
 4. Exterior wall finish: White stucco patterned galvanized steel.
 5. Interior floor finish: 14 gauge smooth galvanized steel.
 6. Door type: Out-swing, 900 mm x 1950 mm finished to match wall panels.
 7. Door accessories for Cold Rooms:
 - a. Nominal 350 mm x 575 mm observation window with electrically heated frame. Manufacturer's standard tempered glass.
 - b. Stainless steel push plate mounted on inside face of door.
 8. Floor coverings: Provide floor matting as specified herein over total area not covered by shelving.
- B. Cold Room Performance:
1. Temperature designation: 4 degrees C.
 2. Temperature Range: -2 degrees to 10 degrees C.
 3. Temperature Control: +/- 0.5 degrees C.
 4. Chamber humidity: 50 percent relative humidity. +/- 5 percent at 4 degrees C.
 5. Humidity control specifications: +/- 5 percent at 4 degrees C.
 6. Temperature uniformity: Sensors must agree within +/- 1 degree C.
 7. Digital temperature and humidity display, chart recorder not required.
- C. Refrigeration Sizing Data:
1. Temperature outside of cold room: 25 degrees C, maximum.
 2. Relative humidity outside of cold room: 30 to 60 percent.
 3. Number of door openings per 24 hours:

- a. Cold Room: 20 at 30 seconds duration each use.

D. Chamber Accessories:

1. Wall mounted, post-type stainless steel with brackets. Post height to be 1850 mm for application with four tiers. Provide posts, wall mounts, and shelf supports.
 - a. Shelves: Stainless steel open wire shelving units for attaching to brackets. Shelves to be minimum 450 mm.
 - b. Stainless steel open wire shelving units with (4) 1850 mm high posts. Provide four tiers of shelving, adjustable on 50 mm centers.
 - c. Unit sizes shall be as indicated on the drawings.
 2. Floor Mat: Provide removable gray 4 mm thick polyvinyl chloride diamond tread floor mat to cover all areas of the floor not occupied by shelving.
 3. Electrical Receptacles: Individual outlets shall be vapor proof corrosion resistant duplex receptacles, gray PVC boxes and covers. Outlets provided with weatherproof covers and mounted approximately 1125 mm above the floor or as shown on the architectural drawings. All other interwiring through PVC conduit that is UL listed. Provide quantity as specified on drawings.
 4. Lighting shall be vapor proof, 120V, fluorescent fixtures equipped with high output, cool white T-12 bulbs and low temperature ballasts. The light fixtures shall be UL listed. The construction of the housing shall be corrosion resistant fiberglass or ABS plastic. Incorporate into the design, a clear prismatic acrylic lens with closed cell neoprene gasketing bonded to the housing to form a continuous seal for the lens. Lighting shall be of sufficient quantity and intensity to provide 753 to 1075 lx at 900 mm above the floor and at 4 degrees C. Lighting shall be so installed as to provide a uniform distribution of light. A light switch with pilot light shall be located on room exterior near entrance door. Rooms shall be equipped with one (1), 40W, vapor proof, safety light fixture located above each door. Safety lighting shall be powered only during alarm conditions.
 5. Furnish and install the necessary vertical and horizontal closure panels, strips and shrouds to enclose openings between cold rooms, adjacent walls, and ceilings. Finish of closure panels to match exposed exterior finish of room panels. Use removable fasteners to allow for closure trim above rooms to act as access point.
 6. Ceiling Plenum: To contain evaporators, heating elements, control valves and other equipment necessary to condition the air to maintain specified space conditions.
- E. Miscellaneous Services: Condensate drain installed under this section. Pipe to drain indicated on plumbing drawings.
- F. Mechanical Systems:
1. Location of condensing units shall be above the cold rooms.
 2. Condensing unit cooling: Air-cooled.

3. Electrical power: Supply voltage as shown on electrical drawings.
4. Provide condensing unit with a removable, metal mesh cover to protect unit from damage.

G. Service: Type of service required: Standard response - within 24 hours.

2.2 FABRICATION

A. Metal Panels:

1. Wall, ceiling and floor panels shall be a combination of manufacturer's standard and custom sizes used to construct room enclosure in accordance with the exact sizes noted above or on the contract drawings. Where sizes are not provided, cold rooms shall fit the available space to within 50 mm of all surrounding structures.
2. The rooms shall be constructed of double wall; modular, prefabricated metal skinned polyurethane panels. The panels shall be constructed of high quality components with 100 percent of each panel exclusive of its metal skins and steel supports as being comprised of polyurethane insulation. Each of the room's four corners shall be a preformed 90-degree angle. No panel shall be less than 288 mm horizontal dimension. Construction shall comply with Factory Mutual Standards and National Sanitation Foundation (NSF). No structural metal, wood, or fiberglass material shall be used between interior and exterior skins. To insure that all joints are airtight and vapor proof, all panels' edges must have a foamed-in-place tongue and groove edge, which is of the same density as the rest of the panel. The interior and exterior perimeter of each male edge must have a foamed-in-place flexible vinyl gasket. This gasket shall not be stapled or glued, and shall be resistant to damage from oil, grease, water, detergents, and sunlight.
3. Panels shall be equipped with cam-action locking and joining devices. The distance between locks shall not exceed 1200 mm. Each device shall consist of a cam-action, hooked locking arm placed in one panel, and a steel rod positioned in the adjoining panel, so that when the arm is rotated, the hook engages over the rod and draws the panels tightly together with cam action. Arms and rods shall be housed in individual steel pockets.
4. Floor panels, where utilized, shall be similar to all other panels but shall be made to withstand uniformly distributed floor loads up to and including 2929 kg/m². Floor panel thickness shall be 50 mm and shall be NSF coved corner design.
5. Panels must be rated as a Class I building material and have passed a corner burn test with FM or UL.

B. Insulation:

1. The insulation shall be 100 mm thick, rigid urethane foamed-in-place using an HCFC blowing agent. The thermal conductivity factor (K) shall not exceed 0.118 BTU/hr./sq.ft./degree Fahrenheit/in. Overall coefficient of heat transfer (U-factor) shall not be more than 0.029 for 100 mm walls. The R factor shall

have a value of 34. Insulation shall have 97 percent closed cell structure and an average in-place density of 3.6 kg/m³. Insulation shall meet 1998 CFC standards as set by the 1987 Montreal Protocol, employing a process that reduces CFC use by 60 percent or more.

C. Doors:

1. Each door shall be sized per room requirements listed above.
2. The door shall be in-fitting flush mounted swing-type with the same metal finish and insulation as adjacent walls and provide a minimum clear opening of 850 mm by 1950 mm. Provide a thermoplastic door gasket at the top and along the sides, shall be extruded vinyl, resistant to oil, fats, and sunlight, and shall be easily replaceable with a magnetic core shall be mounted on the top edge and along both sides of the door. The magnetic force of the gasket shall keep the door closed and the gasket shall form a tight seal. The bottom edge of the door shall contain a flexible dual blade wiper gasket. All gaskets shall be NSF approved. Construction of the door panel shall include a reinforced frame around the entire perimeter of the door opening to prevent racking or twisting.
3. The latch shall have a cylinder lock with provisions for padlocking. It shall also include an inside safety release handle to prevent anyone from being locked in the chamber. This safety release shall be a lever device or other mechanism in compliance with the Americans with Disabilities Act of 1990. Door hardware shall be brushed aluminum or chrome.
4. Observation Window: Manufacturer's standard heated observation window shall be provided and it shall consist of three panels of glass with sealed air spaces between them. The window shall be removable for replacement. Window to be sized per room requirements listed above.

D. Pressure Relief Port:

1. Pressure relief ports shall be utilized for all chambers operating at a temperature of -18 degrees C or below. The relief port shall be provided to equalize the difference in exterior and interior pressure caused by sudden temperature changes. The relief port shall be heated to prevent freezing.

2.3 CONTROL PANEL AND INSTRUMENTATION

- A. Location: A control console incorporating a key locked door with a clear acrylic window shall be required for viewing and protecting the settable controls. The console shall be located where shown on the drawings. It shall house all instruments, controls, switches, and pilot lights, alarm contacts and displays. Control panel shall be manufacturer's standard construction with components clearly labeled by a permanent silk-screening process. Control panel front shall be hinged for opening to allow for calibration and maintenance. Control panel housing shall be a durable, impact resistant construction. Essential controls, alarm and set points should be at heights in compliance with the Americans with Disabilities Act.

- B. Temperature Controller: Temperature control shall be through a fully programmable, microprocessor based digital controller with RTD sensing (resistive temperature detectors). Sensitivity of the sensors shall not be less than .01 degrees C over the entire range of the chamber. The sensor shall be located so as to detect average temperature within the room and be protected against damage. The control components shall control capacity of the refrigeration/conditioning system and be designed to meet the performance criteria of the chamber as specified. Setpoint shall be through the digital control and readout shall be in degrees Centigrade. The controller shall simultaneously display the actual condition and setpoint. Accuracy of correlation between temperature set point and the true National Board of Standards temperature resulting from this setting shall be +/- 0.5 degrees C.
- C. High/Low Temperature Safety Alarms: High and low temperature safety alarm system shall be independent, individually adjustable, microprocessor based, temperature safety controllers providing activation for audible and visual alarms, and corrective measures. Safety controllers shall have a digital readout and simultaneously display the actual room condition and setpoint. Safety alarm system shall be adjustable within 2 degrees C of the desired operating temperature. The alarm system shall shut off all heat producing equipment, except safety lighting, in the event of a high temperature alarm, and shut off all heat removing equipment in the event of a low temperature alarm. Provide two (2) extra dry contacts each (one normally closed, one normally open) for connection to central building alarm and/or monitoring system. Alarm system shall also include an adjustable silence feature for audible alarm.
- D. Defrost Control: On chambers operating below 6 degrees C, provide a control settable for a minimum of six (6) defrosts periods in a 24-hour period.
- E. Humidity Control: If dehumidification or humidification of chambers is required to achieve parameters as specified above, provide a fully programmable, microprocessor based digital controller with thin film capacitive type sensing. Accuracy of the sensor shall not be less than 2.0 percent relative humidity over the entire range of the room. Sensor shall be located to detect the average relative humidity within the room and protected against damage. The controller shall have a digital readout and simultaneously display the actual room conditions and setpoint. Readouts shall be in percentage relative humidity.
- F. Units designed for operation below 10 degrees C, or equipped with humidity control, shall be provided with an adjustable defrost system. Defrost system shall be a hot gas system and include a twenty-four (24) hour timer and fan delay. Rooms designed for operation below -4 degrees C shall be provided with timed and temperature terminated electric defrost.

2.4 MECHANICAL DESIGN

- A. Condensing Unit: Units shall be specifically designed, engineered, manufactured, and of adequate capacity to fulfill the individual room operating temperature and/or humidity requirements and performance,

and shall be balanced with the air handling system in operation and capacity. Units shall be complete in all respects and shall include semi-hermetic compressor, condenser, receiver, suction accumulator, high/low pressure control, sight glass, filter dryer, solenoid and relief valves, vibration isolators, interconnecting piping, hot gas proportioning valve, piping insulation, and all other components necessary to achieve specified performance, while providing a safe, reliable, and serviceable system.

1. Compressors shall be furnished to operate on the following:
 - a. 480V, 3 phase, 60 Hz service.
 2. Condensing unit shall be the following:
 - a. Air-cooled type.
- B. Air Handling Plenum: Contains evaporator units, fans, drain pans, heating elements, thermal expansion valves, and a lay-in, open-cell diffuser panel ceiling.
1. The conditioned air shall pass into a supply air plenum made up of acrylic, open-cell diffuser panels supported by an anodized aluminum grid. Plenum shall extend from the evaporator unit across the entire room and insure uniform air distribution throughout the room to achieve and maintain specified performance.
 2. Evaporator units shall be suspended from room roof panels, and consist of copper tube, aluminum fin coils, fans, and drain pans. Unit shall have hinged access for service and maintenance. Hinged access shall not interfere with air handling plenum or lay-in diffuser panel ceiling. Evaporator unit fans, fan guards, and drain connection shall be unexposed, located above diffuser panel ceiling. Evaporator enclosure material shall be white smooth aluminum.
 3. Conditioning design based on hot gas bypass with extended life rapid cycle solenoids with proportional heat control or a fully proportional, modulating system which controls both liquid and hot gas flow. Standard unit coolers are not acceptable.
- C. Dehumidification: Chamber dehumidification shall utilize a desiccant drier package with an automatic regenerative desiccant drier for lowering of humidity from ambient to the minimum humidity level specified. Unit shall automatically modulate the amount of dry air needed from the regenerative drier to prolong equipment life and lower operating costs. Dryer shall be furnished complete with ductwork, dampers, and electrical control panel. Control panel shall be mounted on or integral to the cabinet which shall house the motor starters, overload protection devices, pilot lights, control relays, switches, safeties, and all protective fuses and necessary components to insure continuous, safe, automatic operation.
- D. Piping:
1. Tubing: ACR type, hard drawn, cleaned and capped Type L copper tubing soldered with silver solder, except hot gas lines which

- shall be silver brazed. All lines shall be installed to allow for linear expansion of copper after start-up.
2. Suction and Hot Gas Pipes: Size for velocity of 500-700 FPM on horizontal runs and show a slight pitch toward condensing unit. When condensing unit is located below evaporator, and there is no possibility of trapping oil, size vertical runs. When condensing unit is located above evaporator, size vertical runs for velocity of 5.1-7.6 m/s.
 3. Liquid Pipes: Size all liquid pipes for maximum 2 PSIG pressure drop.
 4. Hangers: F & M ring type or Unistrut assemblies with appropriate tubing clamps to support liquid, suction, and discharge pipes individually. Space supports 2400 mm O.C. maximum.
 5. Condensate Drain Piping: 22 mm outside diameter, or greater, Type L copper tubing piped from evaporators to open floor drain, rigidly support at walls 1500 mm O.C. maximum, installed in such manner that leaves 25 mm clearance space between wall and drain. Floor drain to be located outside of room. Adequately pitch piping toward floor drain and carry through wall of refrigerated areas properly trapped and discharged in floor drain.
 6. Refrigerant Testing: Pressurize and leak test entire system at not less than 200 PSIG. Clean and dehydrate by maintaining a vacuum of 500 microns, or lower, for a five hour period.
- E. Insulation: Fire retardant insulation for insulating refrigeration suction and hot gas lines. Use minimum 13 mm thick wall. Apply during tubing assembly wherever possible.
- F. Electric Heaters: Shall be Ni-chrome wire wound heaters.
- 2.5 U. L. LISTED
- A. The room shall be listed by Underwriters' Laboratories. Electrical wiring and components shall meet their standards.
- 2.6 N.S.F. LISTED:
- A. The room shall be listed by the National Sanitation Foundation and the design and construction shall meet their standards.
- 2.7 SERVICES
- A. Coordinate design of the room to accommodate services described, provided, and installed by others. Provide reinforcement for wall penetrations as recommended by wall system manufacturer. Seal penetrations after installation of services by other trades.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine and verify areas and work of other trades for conditions that affect the work of this section.
- B. Report unsatisfactory conditions to the Contracting Officer in writing.
- C. Do not begin installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Manufacturer's personnel or manufacturer's representative shall perform installation and start-up. Manufacturer shall supply factory trained, on-site supervision at all times when work of this section is performed.
- B. Deliver to job site, uncrate and place in proper locations, and reassemble all equipment specified herein. All debris, crating materials, and trash shall be removed. Components shall not be exposed to weather.
- C. Electrical:
 - 1. Provide all electrical work integral to the cold rooms, including control panel, evaporator units, heaters, lights, and receptacles.
 - 2. Connection of interlocking control wiring between control panel and remote compressors or heaters, also between fan/coil unit and remote compressors, or heaters, where required.
- D. Provide condensate drain piping to building drainage system.
- E. Final connections of building utilities to room will be made by HVAC, plumbing, and electrical contractors.

3.3 TESTING AND TRAINING

- A. Provide all equipment for testing and perform all tests. Multi-point data logging recorder used for testing will have been certified for accuracy by a recognized testing laboratory within one year prior to test.
 - 1. Temperature uniformity of +/- 0.5 degrees C refers to the temperature as measured on a horizontal plane 1000 mm above floor and within 300 mm of walls throughout the entire room. Uniformity shall be measured by a multi-point data logging recorder utilizing a minimum of twelve (12) thermocouples, distributed evenly around the room during a continuous twenty-four (24) hour test period. Gradient from floor to ceiling shall be 1 degree C or less. Perform tests at the high, low, and middle temperatures of the specified temperature range.
 - 2. Start Up Temperature Test: From ambient, room shall attain preset temperature and stabilize within two hours, with temperature differential of not more than 0.5 degrees C of set temperature.

3. Start Up Humidity Test: From ambient, room shall attain preset condition and stabilize within four (4) hours, then maintain set humidity for a period of eight (8) hours.
 4. Recovery Test: Room shall recover preset operating temperature within five (5) minutes after door has been fully opened to 24 degrees C ambient for a period of one (1) full minute.
 5. Humidity control shall be verified by chart recorder documentation.
 6. Test charts shall indicate (1) control point setting, (2) date and time of test start, (3) chart speed, (4) point where temperature and stabilization are achieved, (5) point where door is opened, (6) signature and designation of individual conducting test, (7) manufacturer and serial number of datalogger and (8) date of certification, name of testing laboratory and certificate number. Printouts shall be clear, legible and with no overprinting.
 7. Costs: Cost of tests shall be included in the contract sum.
- B. Manufacturer shall instruct Owner's staff in the complete operation of room, including controls, after completion of room start-up. Include three (3) copies of the Operation and Maintenance manual indicating sequential operation, start-up and shutdown, and preventative maintenance, with all pertinent control data, schematics, test results, and drawings.

END OF SECTION 13038

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SECTION 13080

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SECTION 13080

SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT

04/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All the latest versions of the referenced publications shall be used.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	Carbon Structural Steel
ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 153/A 153M	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	Carbon and Alloy Steel Nuts
ASTM A 603	Zinc-Coated Steel Structural Wire Rope
ASTM A 653/A 653M	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM E 488	Strength of Anchors in Concrete and Masonry Elements

ASME INTERNATIONAL (ASME)

ASME B18.2.1	Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	Square and Hex Nuts (Inch Series)

COE TECHNICAL INSTRUCTIONS (TI)

TI 809-04	Seismic Design for Buildings
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1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the mechanical equipment and systems. The electrical equipment and systems outlined in Section 16070 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT, Section 15070 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT, and the miscellaneous equipment and systems listed below. Seismic protection requirements shall be in accordance with TI 809-04 and additional data furnished by the Contracting Officer, and shall be provided in addition to any other requirements called for in other sections of these specifications. The design for seismic protection shall be based on a Seismic Use Group I building occupancy and on site response coefficients for $S_{MS} = 0.336$ and $S_{M1} = 0.213$. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. The basic force formulas, for Ground Motions A and B in Chapter 3 of TI 809-04, use the design spectral response acceleration parameters for the performance objective of the building, not for equipment in the building; therefore, corresponding adjustments to the formulas shall be required.

1.2.2 Miscellaneous Equipment and Systems

The bracing for the following miscellaneous equipment and systems shall be developed by the Contractor in accordance with the requirements of this specification:

Storage cabinets
Storage Racks
Shelving
Partitions

Ornamentations
Signs and Billboards
Furnishings

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Bracing; Equipment Requirements.G RE

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

SD-02 Shop Drawings

Bracing; Resilient Vibration Isolation Devices; Equipment Requirements.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction. For equipment and systems in buildings that have a performance objective higher than life-safety, the drawings shall be stamped by the registered engineer who stamps the calculations required above.

1.4 EQUIPMENT REQUIREMENTS

1.4.1 Rigidly Mounted Equipment

The following specific items of equipment: Boilers, chillers, and air handling units to be furnished under this contract shall be constructed and assembled to withstand the seismic forces specified in TI 809-04, Chapter 10. For any rigid equipment which is rigidly attached on both sides of a building expansion joint, flexible joints for piping, electrical conduit, etc., that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions, shall be provided.

PART 2 PRODUCTS

2.1 BOLTS AND NUTS

Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153/A 153M.

2.2 SWAY BRACING

Material used for members listed in this section and on the drawings, shall be structural steel conforming with the following:

- a. Plates, rods, and rolled shapes, ASTM A 36/A 36M.
- b. Wire rope, ASTM A 603.
- c. Tubes, ASTM A 500, Grade B.
- d. Pipes, ASTM A 53, Type E or S, Grade B.
- e. Light gauge angles, less than 6 mm thickness, ASTM A 653/A 653M.

PART 3 EXECUTION

3.1 BRACING

Bracing shall conform to the arrangements shown. Trapeze-type hanger shall be secured with not less than two 13 mm bolts.

3.2 BUILDING DRIFT

Sway braces for a piping run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided.

3.3 ANCHOR BOLTS

3.3.1 Cast-In-Place

Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. One nut shall be provided on each bolt. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt. Anchor bolts that exceed the normal depth of equipment foundation piers or pads

shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

3.3.2 Expansion or Chemically Bonded Anchors

Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided to verify the adequacy of the specific anchor and application. Expansion or chemically bonded anchors shall not be used to resist pull-out in overhead and wall installations if the adhesive is manufactured with temperature sensitive epoxies and the location is accessible to a building fire. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer.

3.3.2.1 General Testing

Expansion and chemically bonded anchors shall be tested in place after installation. The tests shall occur not more than 24 hours after installation of the anchor and shall be conducted by an independent testing agency; testing shall be performed on random anchor bolts as described below.

3.3.2.2 Torque Wrench Testing

Torque wrench testing shall be done on not less than 25 percent of the total installed expansion anchors and at least one anchor for every piece of equipment containing more than two anchors. The test torque shall equal the minimum required installation torque as required by the bolt manufacturer. Torque wrenches shall be calibrated at the beginning of each day the torque tests are performed. Torque wrenches shall be recalibrated for each bolt diameter whenever tests are run on bolts of various diameters. The applied torque shall be between 20 and 100 percent of wrench capacity. The test torque shall be reached within one half turn of the nut, except for 9 mm sleeve anchors which shall reach their torque by one quarter turn of the nut. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified torque; if the anchor still fails the test it shall be replaced.

3.3.2.3 Pullout Testing

Expansion and chemically bonded anchors shall be tested by applying a pullout load using a hydraulic ram attached to the anchor bolt. At least 5 percent of the anchors, but not less than 3 per day shall be tested. The load shall be applied to the anchor without removing the nut; when that is not possible, the nut shall be removed and a threaded coupler shall be installed of the same tightness as the original nut. The test setup shall be checked to verify that the anchor is not restrained from withdrawing by the baseplate, the test fixture, or any other fixtures. The support for the testing apparatus shall be at least 1.5 times the embedment length away from the bolt being tested. Each tested anchor shall be loaded to 1 times the design tension value for the anchor. The anchor shall have no observable movement at the test load. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified load; if the anchor still fails the test it shall be replaced.

3.4 RESILIENT VIBRATION ISOLATION DEVICES

Where the need for these devices is determined, based on the magnitude of the design seismic forces, selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS, except that an equipment weight equal to five times the actual equipment weight shall be used.

3.4.1 Resilient and Spring-Type Vibration Devices

Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 13 mm.

3.4.2 Multidirectional Seismic Snubbers

Multidirectional seismic snubbers employing elastomeric pads shall be installed on floor- or slab-mounted equipment. These snubbers shall provide 6 mm free vertical and horizontal movement from the static deflection point. Snubber medium shall consist of multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trunnion so both horizontal and vertical forces are resisted by the snubber medium.

3.5 SWAY BRACES FOR PIPING

Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those shown on the drawings. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15140 SUPPORTS AND ANCHORS. Bracing shall consist of at least one vertical angle 50 x 50 mm x 16 gauge and one diagonal angle of the same size.

3.5.1 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided in accordance with Section 15140 SUPPORTS AND ANCHORS, and as shown on the drawings.

3.5.2 Anchor Rods, Angles, and Bars

Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.5.3 Maximum Length for Anchor Braces

Type	Size (millimeters)	Maximum Length* (meters)
Angles	38 x 38 x 6	1.5
	50 x 50 x 6	2.0
	64 x 38 x 6	2.5
	75 x 64 x 6	2.5
	75 x 75 x 6	3.0

Type	Size (millimeters)	Maximum Length* (meters)
Rods	91	1.0
	22	1.0
Flat Bars	38 x 6	0.4
	50 x 6	0.4
	50 x 10	0.5
Pipes (40s)	25	2.0
	32	2.8
	40	3.2
	50	4.0

3.5.4 Bolts

Bolts used for attachment of anchors to pipe and structure shall be not less than 13 mm diameter.

3.6 EQUIPMENT SWAY BRACING

3.6.1 Suspended Equipment and Light Fixtures

Equipment sway bracing shall be provided for items supported from overhead floor or roof structural systems, including light fixtures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 13 mm bolts. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 0.40 times the weight of equipment without exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for acceptance. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

3.6.2 Floor or Pad Mounted Equipment

3.6.2.1 Shear Resistance

Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

3.6.2.2 Overturning Resistance

The ratio of the overturning moment from seismic forces to the resisting moment due to gravity loads shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. Calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

-- End of Section --

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SECTION 13100

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 - 3.1.4 Steel Frame Building
 - 3.1.5 Stacks
 - 3.1.5.1 Metal Stacks
- 3.2 INTERCONNECTION OF METAL BODIES
- 3.3 INSPECTION

-- End of Section Table of Contents --

SECTION 13100

LIGHTNING PROTECTION SYSTEM
09/98

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C135.30 (1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999; Errata 96-4) National Electrical Code

NFPA 780 (1997) Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 96 (1994; Rev thru Dec 1996) Lightning Protection Components

UL 96A (1994) Installation Requirements for Lightning Protection Systems

UL 467 (1993; Rev thru Aug 1996) Grounding and Bonding Equipment

UL Elec Const Dir (1997) Electrical Construction Materials Directory

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

1.2.2 System Requirements

The system furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA

780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Drawings; G, ~~REAE~~

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

SD-07 Certificates

Materials; G, RE

Where material or equipment is specified to comply with requirements of UL, proof of such compliance. The label of or listing in UL Elec Const Dir will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted. A letter of findings shall be submitted certifying UL inspection of lightning protection systems provided on the following facilities: CIL of Fort Gillem, GA.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General Requirements

No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.1.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.1.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 170 kg per 300 m , and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.1.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal. Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and cross-sectional area of a No. 4 AWG aluminum wire. When perforated strips are provided, strips that are much wider than solid strips shall be. A strip width that is at least twice that of the diameter of the perforations shall be used. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least 38.1 mm wide.

2.1.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings used for manufacturing, processing, handling, or storing explosives, ammunition, or explosive ingredients shall be a minimum of 600 mm above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of 1.5 m above the opening. On open stacks emitting explosive dusts, gases, or vapor under forced draft, air terminals shall extend a minimum of 4.5 m above vent opening. Air terminals more than 600 mm in length shall be supported by a suitable brace, with guides not less than one-half the height of the terminal.

2.1.4 Ground Rods

Rods made of solid copper shall conform to UL 467 and galvanized ferrous rods shall conform to ANSI C135.30. Ground rods shall be not less than 19.1 mm in diameter and 3.048 m in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.1.5 Connectors

Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation.

2.1.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

3.1.1 General Requirements

The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.1.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 600 mm from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 600 mm in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 7.5 meters. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 50 mm for each 300 mm of increase over 7.5 meters. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 15 m in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom. Where metal ventilators are installed with air terminals mounted thereon, the air terminal shall not be more than 610 mm away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement. Where metal ventilators are installed with air terminals mounted adjacent, the air terminal shall not be more than 610 mm away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement.

3.1.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 200 mm. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 900 mm along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat

surfaces, and flat roofs shall be connected to form a closed loop.

3.1.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes (i.e., perimeter building grounding loop). Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. The building shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 35 m long, there shall be at least one additional down conductor for each additional 15 m of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 75 m in perimeter, there shall be at least one additional down conductor for each 30 m of perimeter or fraction thereof. There shall be at least one additional down conductor on the wing-built structure, and at least one additional down conductor for each wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 30 meters. On structures exceeding 15 m in height, there shall be at least one additional down conductor for each additional 18 m of height or fraction thereof, except that this application shall not cause down conductors to be placed about the perimeter of the structure at intervals of less than 15 meters. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 5 m in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected by placing in rigid steel conduit for a minimum distance of 1800 mm above finished grade level. The down conductor shall be bonded at the top and bottom of the conduit.

3.1.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.1.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.1.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 3.0 meters. Ground rods shall be set not less than 900 mm, nor more than 2.5 m, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 5 ohms if a counterpoise is not used. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 24 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 5 ohms, the Contracting Officer shall be notified immediately. A counterpoise, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600 mm deep at a distance not less than 900 mm nor more than 2.5 m from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors are then buried in the trenches.

3.1.2 Metal Roofs

Wood-Frame, Wall-Bearing Masonry or Tile Structure with Metallic Roof and Nonmetallic Exterior Walls, or Reinforced Concrete Building with Metallic Roof: Metal roofs which are in the form of sections insulated from each other shall be made electrically continuous by bonding. Air terminals shall be connected to, and made electrically continuous with, the metal roof as well as the roof conductors and down conductors. Ridge cables and roof conductors shall be bonded to the roof at the upper and lower edges of the roof and at intervals not to exceed 30 meters. The down conductors shall be bonded to roof conductors and to the lower edge of the metal roof.

Where the metal of the roof is in small sections, the air terminals and down conductors shall have connections made to at least four of the sections. All connections shall have electrical continuity and have a surface contact of at least 1935 square millimeters.

3.1.3 Metal Roofs With Metal Walls

Wood-Frame Building With Metal Roof and Metal Exterior Walls: The metal roof and the metal walls shall be bonded and made electrically continuous and considered as one unit. The air terminals shall be connected to and made electrically continuous with the metal roof as well as the roof and down conductors. All connections shall have electrical continuity and have a surface contact of at least 1935 square millimeters.

3.1.4 Steel Frame Building

The steel framework shall be made electrically continuous. Electrical continuity may be provided by bolting, riveting, or welding steel frame, unless a specific method is noted on the drawings. The air terminals shall be connected to the structural steel framework at the ridge. Short runs of conductors shall be used as necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained. Separate down conductors from air terminals to ground connections are not required. Where a grounded metal pipe water system enters the building, the structural steel framework and the water system shall be connected at the point of entrance by a ground connector. Connections to pipes shall be by

means of ground clamps with lugs. Connections to structural framework shall be by means of nut and bolt or welding. All connections between columns and ground connections shall be made at the bottom of the steel columns. Ground connections to grounding electrodes or counterpoise shall be run from not less than one-half of all the columns distributed equally around the perimeter of the structure at intervals averaging not more than 18 meters.

3.1.5 Stacks

Metal guy wires for stacks shall be grounded. Metal guy wires or cables attached to steel anchor rods set in the earth will be considered as sufficiently well grounded. Metal guy wires or cables attached to anchor rods set in concrete or attached to buildings or nonconducting supports shall be grounded to a ground rod driven full length into the ground.

3.1.5.1 Metal Stacks

Metal smokestacks shall be electrically continuous and be grounded. Where the construction of the foundation does not provide 5 ohms maximum to ground, the stack shall be grounded to two ground rods driven full length into the earth. Ground rods shall be located approximately 180 degrees apart and shall be set not less than 900 mm from the nearest point of the stack foundation.

3.2 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. Metal bodies of conductance having an area of 0.258 square meters or greater or a volume of 0.0164 cubic meters or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 1935.5 square millimeters. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 1.5 m in any dimension, that is situated wholly within a building, and that does not at any point come within 1.8 m of a lightning conductor or metal connected thereto shall be independently grounded.

3.3 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13200

TECHNICAL SECURITY SYSTEMS, GENERAL

06/01

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-- End of Section Table of Contents --

SECTION 13200

TECHNICAL SECURITY SYSTEMS, GENERAL

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

The Contractor shall provide an Electronic Security System (ESS) as described and shown including installation of any Government Furnished Equipment. All computing devices shall be certified to comply with the requirements for Class A computing devices and labeled.

This Section specifies requirements for submittals, quality assurance, delivery and storage, maintenance, field quality control, acceptance testing, and training for complete and operational security systems.

The Security System shall be developed and installed in accordance with the drawings, specifications, and referenced publications and will include all wiring, raceways, pull boxes, terminal cabinets, outlets, and mounting boxes, and all other accessories and miscellaneous items required for a complete operating system whether or not each item is specifically mentioned or described.

The security system described is the U.S. Army's Integrated Commercial Intrusion Detection System II (ICIDS II). The contractor shall provide systems and components compatible with the US Army's ICIDS systems.

The general contractor (GC) shall provide components as provided in specifications.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures

11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

National standards, most current version, referenced herein are included to establish recognized quality only. Equivalent quality and testing standards are acceptable, subject to their timely submission, review, and approval by G-AE.

Federal Communications Commission (FCC)

47 CFR Parts 15 & 90	Radio Frequency Devices, Field Disturbance Sensors
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Department of Justice

CFR Part 36	Americans With Disabilities Act (ADA)
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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI X3.92	Data Encryption Algorithm
ANSI X3.154	Office Machines and Supplies - Alphanumeric Machines-Keyboards Arrangement

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	Surface Burning Characteristics of Building Materials
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CODE OF FEDERAL REGULATIONS (CFR)

21 CFR 1020	Performance Standards for Ionizing Radiation Emitting Products
47 CFR 15	Radio Frequency Devices
47 CFR 68	Connection of Terminal Equipment to the Telephone Network

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA 170	Electrical Performance Standards - Monochrome Television Studio Facilities
ANSI/EIA/TIA-232-F	Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
EIA ANSI/EIA-310-D	Cabinets, Racks, Panels, and Associated Equipment
EIA/TIA-568-A	Commercial Building Telecommunications Standards
EIA/TIA-569	Commercial Building Standard for Telecommunications Pathways and Spaces.
TIA/EIA-606	The Administration Standard for Telecommunications Infrastructure of Commercial Buildings

TIA/EIA-607

Commercial Building Grounding and Bonding
Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2

National Electrical Safety Code

IEEE C62.41

Surge Voltages in Low-Voltage AC Power
Circuits

IEEE Std 142

IEEE Recommended Practice for Grounding of
Industrial and Commercial Power Systems

IEEE 446

Recommended Practice for Emergency and
Standby Power Systems for Industrial and
Commercial Applications

INTERNATIONAL TELECOMMUNICATION UNION (ITU)

ITU V.34

Data Communication Over the Telephone
Network A Modem Operating at Data
Signaling Rates of up to 28,800 bits for
use on the General Switched Telephone
Network and on Leased Point-to-Point
Two-Wire Telephone Type Circuits

ITU V.42

Data Communications Over the Telephone
Network Error-Correcting Procedures for
DCEs Using Asynchronous-to-Synchronous
Conversion

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250

Enclosures for Electrical Equipment (1000
Volts Maximum)

NEMA ICS 1

Industrial Control and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

National Electrical Code

NFPA 101

National Life-Safety Code

UNDERWRITERS LABORATORIES (UL)

UL 50

Cabinets and Boxes

UL 294

(1999) Access Control System Units

UL 603

Power Supplies For Use With Burglar-Alarm
Systems

UL 609

Local Burglar Alarm Units and Systems

UL 611

Central-Station Burglar-Alarm Systems

UL 632

Electrically Actuated Transmitters

UL 634

Connectors and Switches For Use With
Burglar Alarms Systems

UL 639

(1997; Rev thru Mar 1999) Intrusion
Detection Units

UL 681

(1999) Installation and Classification of

UL 796	Burglar and Holdup Alarm Systems
UL 972	(1999) Printed-Wiring Boards
	(1995; Rev thru Dec 1996) Burglary
	Resisting Glazing Material
UL 1037	(1999) Anti theft Alarms and Devices
UL 1076	(1995; Rev thru Feb 1999) Proprietary
	Burglar Alarm Units and Systems

1.4 SYSTEM DESCRIPTION

The security system described herein provides an integrated system to monitor and control the new USA Criminal Investigation Laboratory. Security Systems shall be locally monitored and report to the Ft. Gillem Provost Marshall's office via a JSIIDS interface. The GFE JSIIDS interface shall be incorporated into the system design and report alarms to the JSIIDS system.

The main lobby provides the primary entrance into the facility via a card reader controlled door. Keypads are used in conjunction with other system components to activate and deactivate interior alarm sensors. Perimeter doors within the complex are monitored by the intrusion detection system and closed circuit television. The loading dock doors serve as a delivery entrance and are equipped with card readers to allow authorized individuals entrance to the facility.

Intrusion Detection is provided by a combination of passive infrared sensors, magnetic contacts and electromechanical sensors in locks. Each sensor is connected to and is part of the Intrusion Detection/Access Control System. Duress alarms are provided at selected areas as shown on contract drawings.

CCTV System provides a means of monitoring selected areas of the facility, alarm verification, and personnel identification. System is monitored and controlled at the facility except as otherwise noted on security system drawings.

CCTV System provides a means of monitoring selected areas of the facility, alarm verification, and personnel identification. System is monitored and controlled at the facility except as otherwise noted on security system drawings.

Power and Signal Conduit and Wiring System provide a secure method of interconnecting security devices and control equipment by providing dedicated conduit systems.

Cabinets and Enclosures provide a centralized location for interconnection of cabling entering and exiting security closets. Additional enclosures house 12/24VDC power supplies for security sensors and devices.

Security power is part of the building emergency power system. All security devices are interconnected to the security power system.

Eight hours of backup power are provided for all low voltage security equipment. Power supplies/chargers are located in security

closets/enclosures.

1.5 Submittals

Shop Drawings: Submit the following in accordance with "Submittal Procedures." Drawings and descriptive data shall be approved by the G-A/E prior to procurement, fabrication, and installation. A schedule of required submittals shall be prepared to be integrated with the overall construction management schedule to ensure adequate review and necessary corrective work before installation. The data package shall include the following:

SD-02 Shop Drawings

- a. System block diagram.;G, A/E
- b. Console installation details, block diagrams, and wiring diagrams.;G, A/E
- c. Local processor installation details, typical block, and wiring diagrams.;G, A/E
- d. Local processor physical layout and schematics.;G, A/E
- e. Device wiring and installation drawings.;G, A/E
- f. Security power interconnections.;G, A/EDetails of connections to power sources, including power supplies and grounding and one line diagrams of security power system.
- g. Riser diagrams for each installed system.;G, A/E
- h. Consolidated system riser diagram.;G, A/E
- i. Sensor detection patterns.;G, A/E
- j. Provide field-wiring diagrams of systems. ;G, A/E
- k. Provide equipment finishes for approval.;G, A/E
- l. CCTV system interconnection diagrams.;G, A/E
- m. Security cable list. Consolidated list of all security cable runs by wire/cable type, to/from, designated number, # of conductors.;G, A/E
- n. Elevations and Plans for each installed component.;G, A/E
- o. Results of all cable tests.;G, A/E
- p. Security system test plan;G, A/E

SD-03 Product Data

- a. Provide detailed, itemized equipment list. ;G, A/E
- b. Provide manufacturer's catalog cut sheets. ;G, A/E

SD-07 Certificates

- a. Installer's qualifications.;G, A/E

SD-06 Test Reports

- a. System Acceptance and Test Plan.;G, A/E

SD-10 Operation and Maintenance Data

- a. Submit operation and maintenance manual.;G, A/E

SD-11 Closeout Submittals

- a. Submit record drawings.;G, A/E

1.6 GUARANTEE/WARRANTY

Attention is directed to provisions of CONTRACT CLAUSES AND CONDITIONS and SUPPLEMENTARY CLAUSES AND CONDITIONS regarding guarantees/warranties for work.

Manufacturer, Contractor, and Subcontractor provide their standard guarantees/warranties for their work under this Section. Such guarantees/warranties are in addition to and not in lieu of other liabilities which Manufacturer, Contractor and Subcontractor may be required to have by law or by other provisions of Contract Documents.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to PRODUCTS AND SUBSTITUTIONS for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Installer's qualificationsSystem shall be installed by Contractor with at least five (5) years experience in installation of systems of a magnitude similar to those specified herein. Security systems shall be installed in compliance with NFPA-70, NFPA 101, EIA/TIA standards, and contract drawings. GC personnel installing wire and cable shall be certified LAN cable installers. Include names, locations, and points of contact of at least two installations of the same type and design as specified herein where the installer has installed such systems. Indicate the type of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 12 months

The Contractor shall provide a plan to the G-AE for a quality assurance program. This plan shall describe the inspection and verification methods to be used by the Contractor to ensure all Work (materials, equipment, and installation) conform with the requirements specified herein. Five sets of the Plan shall be submitted to the Architect and five sets to G-AE within 90 days after contract award.

1.9 Construction Documents

Refer to CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS and PROJECT COMPLETION for requirements and submittal procedures pertaining to Construction and Project Record Documents. After receiving tentative acceptance from the G-AE of materials and equipment lists, and before ordering, purchasing, fabricating, or installing any materials or equipment, the contractor shall submit Shop Drawings of the Security System to demonstrate compliance with the Contract Documents. Submit Shop drawings, manufacturers data, and equipment lists in conformance with SUBMITTALS. Shop drawings shall be accurately scaled drawings, showing methods of fabrication, interconnection, and wiring diagrams, schematics, wire and conduit sizes, installation, and equipment locations, and details of installation, as well as all field verified (by contractor) conditions and dimensions necessary for satisfactory installation. Freehand sketches are not acceptable. Copies of manufacturers cut-sheets shall not be accepted as Shop Drawings. Do not reproduce Contract Drawings with freehand mark-ups as Shop Drawings. Provide submittals at one time with a complete presentation of each system in order to assure that systems are integrated. Provide electronic CADD copy of drawings and spreadsheets. Construction/record drawings include

- a. Elevations and plans for each installed component. Floor plans,

including walls, doors, and door swings, with assigned room numbers indicated, showing exact locations of devices, equipment, and power circuits installed. Provide exact conduit routing with location of junction and pull boxes. Legends indicating device type and manufacturer's model number. The overall system schematic shall indicate the sequence of operation, the relationship of integrated components on one diagram, and show power source, system controls, impedance matches, plus number, size, identification, and maximum lengths of interconnecting wires.

- b. Security cable list Wiring run sheets with cable identification numbers and terminal strip numbers. Consolidated list of all security cable runs by wire/cable type, to/from, designated number, # of conductors
- c. Mounting details for equipment and hardware..
- d. System block diagrams. Functional block diagrams of all installed systems.
- e. Local processor physical layout and schematics. Wall elevations of equipment closets showing exact configuration and installation of chassis, power supplies, junction and pull boxes, equipment enclosures, and conduit in each security closet
- f. Systems test documentation.
- g. Electronic copy of all drawings.

1.10 Operation and Maintenance Data

Provide operation and maintenance data manuals complying with OPERATING and MAINTENANCE DATA and the following:

- 1. Submit operation and maintenance manuals in accordance with PROJECT CLOSE-OUT.
- 2. Provide manuals at least two weeks prior to final acceptance testing.

Provide operator's manuals, which contain complete guidance and description of procedures for operation of systems and comply with the following:

- 1. Include step-by-step instructions for system functions.
- 2. Basic concepts fundamental to understanding system operation.
- 3. Description of operator initiated control, maintenance, and diagnostic procedures.
- 4. A definition of terms peculiar to systems.
- 5. Names, addresses, and telephone numbers of Manufacturer, Manufacturer's representatives, and Subcontractor who performed work or furnished material for project.
- 6. Description of functional and operational requirements established for system and its functions. Provide description written clearly, concisely and without use of technical jargon so that general reader can comprehend.

7. Detailed documentation, readily understandable to technical personnel, stating theory of operation, design philosophy, and specific functions of each security system and its operating modes. Provide hardware functions, interfaces, and requirements detailed for system components in every system function and operating mode. Provide a complete system description to include operators interactions functionally described. Provide description of known or established constraints on system operation. Provide description of operating procedures currently implemented or planned for implementation in an automatic mode.

8. Provide documentation of user performed maintenance, fault diagnosis, and repair or replacement of sensors and controls.

9. Provide recommended spare parts list to maintain system for a two-year period, based on strategy of minimizing time that major system components are out of service, failure histories, priority of system components, and current costs. Prioritized list accounts for distances from installation to regional service organizations, as well as, normally expected procurement time.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Particular manufacturers, products, trade names, model numbers and assemblies herein mentioned are named to establish a standard of quality, operation, and sizing and not to limit competition. Equivalent products shall be acceptable, subject to approval of G-AE. Refer to PRODUCTS AND SUBSTITUTIONS for provisions pertaining to substitutions of materials. Once approved by COR, no substitutions are authorized.

Unless otherwise noted, equipment provided for this work are to be standard products from companies who have been manufacturing similar equipment for at least five (5) years. Products proposed for use must have been in operation a minimum of six (6) months in a completed facility for use on this project.

Provide equipment, which is new and meets or exceeds latest published manufacturer's specifications. Deliver equipment in manufacturer's cartons. No previously used, reconditioned, or remanufactured equipment is authorized.

Expansion Capacity: The Security System shall be capable of a minimum of 100% expansion of access control points. Intrusion detection or alarm points shall be capable of a minimum of 50% expansion.

2.2 EQUIPMENT

Unless otherwise noted, equipment provided for this work are to be standard products from companies who have been manufacturing similar equipment for at least five (5) years. Products proposed for use must have been in operation a minimum of six (6) months in a completed facility for use on this project.

Provide equipment, which is new and meets or exceeds latest published

manufacturer's specifications. Deliver equipment in manufacturer's cartons. No previously used, reconditioned, or remanufactured equipment is authorized.

Expansion Capacity: The Security System shall be capable of a minimum of 100% expansion of access control points. Intrusion detection or alarm points shall be capable of a minimum of 50% expansion.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Review drawings and notify G-AE of any required revisions or additions.

Provide interface and coordination with other contractors, suppliers, or manufacturers of electronic door hardware, electric gate openers, and vehicle restraint barriers as specified in other sections. Review specifications for these devices and notify G-AE of any required revisions or additions to these devices.

Provide test equipment required for system check-out and acceptance tests.

Completed systems must fully comply with relevant standards of Underwriters Laboratories. Installation must conform to requirements of current National Electrical Code (NEC).

Coordinate actual device locations with furnishings and fixtures. Any conflicts shall be brought to the attention of the G-AE.

Security Fasteners: All security equipment and components installed in exposed or public areas shall be secured from unauthorized opening by approved security/tamper resistant fasteners.

3.2 System Acceptance and Test Plans

Installation contractor shall prepare system test plans for approval by G-AE. Test plans shall delineate each system component and method of testing. Test plans and schedule shall be submitted to G-AE for review and approval 90 days prior to scheduled tests. Testing shall not commence prior to approval of test plans by G-AE.

Test and acceptance shall be performed in three stages as follows:

a. Contractors Preliminary Tests: Following installation, the contractor shall individually test each sensor, device, and component to verify proper functioning. Corrections and adjustments shall be made until items comply with specifications and design intent.

b. System Operation Tests: Upon completion of Contractors Preliminary Test, the entire system shall undergo a "burn-in" period to assure that all components are compatible and function properly as a complete system. This will be considered a formal test and will be known as the "System Operation Test", in which all components are demonstrated to operate together as an integrated system. The contractor shall perform the

test without stoppage for a continuous seventy-two hour period. A detailed test log shall be maintained to record test results on all components. All failures will be entered in the log along with corrective actions. The log will be submitted to the G-AE for review and comment.

c. Owner's Acceptance Tests: Upon completion of the System Operation Test, the system shall be subjected to a complete functional and operational test. This test shall be performed on the basis of verification by demonstration. Any test procedure resulting in an unsatisfactory performance shall be subject to verification by inspection and testing. The G-AE and/or his representatives shall witness this test. Witnesses will not actively participate in system testing but will observe only. Every sensor, device, and component will be ran through it's complete operation range during this test. The contractor will provide all necessary instruments, labor, materials, manufacturers technical representatives, and qualified technicians required for the test within time limits imposed by this specification.

d. At the conclusion of the test, the contractor shall submit a detailed "punch list" of all deficiencies identified during the test to the G-AE for review. A written report will accompany the punch list identifying the dates that each deficiency will be corrected.

Contractor shall submit test plans for all installed devices to include wire and cable. Test plans shall document the operation of installed components and adherence to manufacturers specifications. Wire and cable shall be tested using Time Domain Reflectometers (TDR) and Optical Time Domain Reflectometers (OTDR). All tests shall be fully documented to include wire traces.

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SECTION 13210

INTEGRATED INTRUSION DETECTION/ACCESS CONTROL/BADGING SYSTEM

06/01

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SECTION 13210

INTEGRATED INTRUSION DETECTION/ACCESS CONTROL/BADGING SYSTEM

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This section describes a continuous duty, on-line, computer based, integrated intrusion detection, access control, and badge generation system, hereafter referred to as the System. The system is based on the Integrated Commercial Intrusion Detection System II (ICIDS II). The System utilizes a Monitor Dynamics, Inc. (MDI) dual file server computer with workstations, remote terminal units, card readers, and badge generation equipment, designed to work as a single, harmonious system. The system interfaces with alarm sensors, door locking devices and ADA operators, and CCTV systems.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

The System shall consist of the following major components:

1. Pre-Processor Unit
2. Combination Access Control, and Security firmware and software
3. Workstation/Network Hub
4. Intelligent Field Panels
5. Proximity Card Readers
6. Fiber Optic Communication Devices

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

2.2 EQUIPMENT

The system shall be an integrated intrusion detection and access control system. The System shall automatically grant or deny access to card access attempts. The system shall monitor alarm points, and report alarms, trouble, or tamper conditions and all battery status.

The system shall consist of the minimum following components:

1. The monitors on the system shall be 15" VGA color monitors.

2. The system shall support several types of printers. Each workstation shall be able to support 2 printers, one for reports, one for alarm activity. The system shall utilize regular fan-fold dot matrix printers, and shall be able to support other types of printers as well.

3. Workstations shall be equipped with 64 MB of RAM. File servers must be equipped with 128 MB of RAM.

4. All software required to use the system shall be included. The system shall be Year 2000 compliant.

5. The operating system shall be Microsoft NT.

6. The application software shall be a single vendor's unmodified (i.e. off the shelf) package. All option packages required to operate the system as specified shall be purchased and installed. Graphics software and maps shall be provided.

7. Workstations shall connect via a local area network (LAN).

The system shall use intelligent field panels.

1. The field panel shall be capable of making intelligent card access decisions in the event communications with the polling device has failed.

2. All field device interfacing shall be through a single type of panel. The panel shall be capable of accepting alarm inputs (both fire and security), card readers, and output modules, with full UL listings for all functions.

3. Field panels shall be capable of accepting 32 supervised inputs, or 24 supervised inputs and 8 card readers.

Field panels shall have both a primary and secondary communication circuit.

All components shall be internal to the field panel. Panels provide dedicated phone line, RS-485 multidrop, and fiber optic communication options.

Each field panel must be supplied with battery backup for a minimum of 8 hours of emergency power. Each panel shall have sufficient battery power to operate without primary power for 8 hours. System shall automatically recharge batteries when battery power is low. The field panel shall inform the CPU when batteries are low, when AC power has failed, when AC power has restored, and when batteries have recharged.

DES Encryption meeting DCID 1/21 standards shall be available for communication lines from/to field panels and between/among workstations.

The system shall support fiber optic communications.

The system shall support card readers and biometric devices.

The system shall support alarm monitoring. and poll each alarm point a minimum of 8 times per second. System must accept dry contact and be capable of generating alarms based upon changes in defined sensor state (normally open or normally closed).

Anti-passback shall be supported by the system and be capable of being activated or deactivated by user.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Install remote terminal units, preprocessor units, card readers and associated equipment in compliance with Parts 1 and 2 of this Section.

Install termination boxes for card readers on secure side of access door and, where possible, in an accessible location above ceiling.

Install remote terminal units, preprocessor units, card readers and associated equipment as shown on contract drawing and interface with Card Access System as described herein.

System hook-up shall conform to design drawings, these specifications, and NEC.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

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SECTION 13214

INTERCOMS

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PART 3 EXECUTION

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SECTION 13214

INTERCOMS

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This section specifies materials and equipment necessary for completion of work for an intercom system without limiting generality thereof.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

Intercoms are to be supplied and installed by the contractor.

Intercoms provide a means to intercommunicate between selected entry points and the facility.

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

Intercoms are to be equivalent to those manufactured by Aiphone.

2.2 EQUIPMENT

A. Provide materials and labor necessary to interconnect Intercoms as indicated on contract drawings.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Install intercoms as shown on drawings.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

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SECTION 13220

CLOSED CIRCUIT TELEVISION SYSTEM

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PART 3 EXECUTION

- 3.1 INSTALLATION, GENERAL
- 3.2 SYSTEM TEST AND ACCEPTANCE

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SECTION 13220

CLOSED CIRCUIT TELEVISION SYSTEM

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This Section specifies materials and equipment necessary to complete work for closed circuit television (CCTV) system without limiting generality thereof.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

Closed circuit television (CCTV) system provides a means of remotely monitoring selected internal and external areas of the NGIC facility. CCTV cameras shall be monitored and remotely controlled by equipment in the CMS.

The CCTV system shall be interfaced with the intrusion detection/access control system to automatically call-up cameras interconnected to alarms.

1.5 Submittals

A. Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

B. Security Contractor shall submit detailed shop drawings of all proposed CCTV installation locations, methods, equipment, and materials as required by contract documents. NOTE: Security Contractor shall schedule a meeting with Construction Manager or Architect as soon as feasible after contract award to review all manufacturers' options related to colors, finishes, materials, trims, designs, and similar aesthetic choices, of all exposed CCTV equipment. Although this Specification may identify aesthetic selections, Construction Manager's and Architect's explicit approval is mandatory. In calculating his costs, Security Contractor shall make allowances for the potential requirements of this paragraph

C. Shop drawings shall additionally show viewing area "fans" and shall indicate the angle of the fan. The full range of telephoto and wide-angle areas of view shall be illustrated. Prior to final acceptance tests, Security Contractor shall make face-plate illumination measurements of each camera position and report the results in writing to Architect and Construction Manager. In the event that any CCTV scene does not have adequate illumination (based on face-plate illumination measurements performed by the Security Contractor) to meet minimum manufacturer's standards for full picture quality, infrared illuminators shall be provided by the Security Contractor, if requested by Architect or Construction Manager

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

2.2 EQUIPMENT

A. The Security Contractor shall furnish and install all CCTV System, control wiring, fiber optic cabling, and all attendant and associated hardware and system components to interface the CCTV cameras with the CCTV system control. Provide CCTV components as follows:

1. The camera shall be a 1/3-inch format high-resolution color camera. All cameras shall use fiber optic cable for video and control.
2. High resolution, 20" color monitors.
3. Sixteen channel video multiplexers for routing of camera video to VCRs for continuous time-lapse recording. The multiplexer shall provide multiplexed encoding of up to sixteen video cameras onto a single video recorder, decoding of encoded tapes for monitor display, digital multiscreen monitor displays, alarm operation, digital motion detection, and time/date/titling.
4. Time-lapse video cassette recorders for recording and playback of mulit-plexed video. The video cassette recorder (VCR) shall be a time-lapse unit based on the Super-VHS 1/2-inch video tape cassette. The recorder shall be equipped for installation in a standard EIA 19" instrument rack. The re-corder shall be UL listed and meet FCC requirements for a Class B device.

B. Provide mounts, supports, and enclosures as required for specific camera mounting conditions as shown on security system drawings. All exterior cameras and housings shall have heaters appropriate for the ambient conditions. All mounts and enclosures shall be designed to tastefully blend in with surroundings where possible. Roof mounts will be custom manufactured to allow mounting under unique conditions as shown in the contract drawings.

1. Outdoor high speed, pan-tilt-zoom cameras shall be weatherproof color units.

C. Provide BNC coaxial cable connectors for termination of RG-59/U video cable equivalent to those required by the CCTV manufacturer.

D. The unitized camera/dome assembly shall be a self-contained unit that incorporates an integral color camera, pan and tilt motor, zoom lens and receiver/driver. The unitized surveillance device shall be a Panasonic Model WV-CST604 or equivalent.

1. 1. The camera shall have a diameter of 5 1/8". The camera shall feature an advanced 1/4" CCD with a built-in complimentary color filter and 768(H) x 492(V) pixels with microlens on each pixel. The camera shall be equipped with digital signal processing (DSP) to produce a high quality picture with a horizontal resolution of over 480 lines with a minimum illumination of 6 lux (f/1.7). The camera shall feature horizontal noiseless aperture correction, vertical 2H enhancer,

high-light aperture and knee circuit for wide video dynamic range. The camera shall be equipped with an auto back light compensation mode as part of the light control function. The automatic backlight compensation shall feature mask setting and level adjust capability. The camera shall be equipped with a built-in digital motion detector with mask setting and level adjustment as well. The camera shall also be equipped with an electronic sensitivity up feature to enhance camera performance in extreme low light conditions. The camera shall feature auto tracing white balance capability with a 48 section mask and level adjustment capability for accurate color reproduction. The unitized surveillance device shall feature an electronic shutter adjustable from 1/100 to 1/10,000 seconds. The camera shall feature an alphanumeric title of 16 characters.

2. 2. The unit shall incorporate a 10X zoom lens with a focal length of 6.5-65mm. The zoom lens shall have an auto iris and auto focus feature that shall allow manual override if the need arises. The minimum aperture throughout this range shall vary from a minimum of f/1.7 at the wide angle setting to f/2.5 at the telephoto lens position.

3. 3. The camera synchronization shall be internal, line-lock and VD (vertical drive) lock over a single coaxial cable when used with optional Matrix System 500. The camera shall be enclosed in an aluminum diecast housing and UL listed.

4. 4. The pan and tilt motor shall be a high-speed unit allowing 360° rotation with a tilt angle of 90°. The pan and tilt shall allow for preset sort and sequence rotation speed of 240° per second. The unitized surveillance device shall feature a minimum of 64 preset positions that shall be programmable via the matrix switching system. The camera shall automatically sequence through the preset positions in logical programming order (sequence mode) or actual position (sort mode). The camera shall include 10 programmable scene files, each of which may assign a combination of special camera settings such as built-in digital motion detector and electronic sensitivity up. Any scene file shall be able to be assigned to a camera preset position for optimum camera performance in difficult lighting conditions. The pan and tilt section shall feature automatic panning mode. The automatic panning limits and speed adjustment shall be selectable from an on-screen menu and not with mechanical or physical limit stops. The dome assembly shall come pre-wired from the factory.

D. Provide fiber optic transmitters, receivers, rack mounts, cabling, and fiber optic connectors for termination of fiber optic cabling.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Furnish and install camera mounting devices. Fixed camera mounts shall include an adjustable head for adjustment of camera viewing area. Mount CCTV cameras per security system drawings.

B. Procure, install, connect, and operationally test cameras, switches, monitors, amplifiers, and fiber optic couplers.

C. Furnish and install cable, connectors, and necessary power cable extensions with appropriate connectors. Flexible weatherproof conduit extensions and/or cable shall be furnished for exterior camera locations as required.

D. Provide power to each camera by means of a separate circuit breaker. Terminate power wiring in a termination box housing for connection to a 24VAC transformer. Box to be installed within 75 cm of camera location. Connect all CCTV equipment to same power phase.

E. Adjust Cameras and Monitors after installation for appropriate viewing field, contrast, and brightness of picture. Test to ensure proper video signal levels.

F. Clean exposed surfaces and lenses. Touch-up or replace damaged and marred finishes.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

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SECTION 13222

SECURITY SYSTEM ALARM SYSTEMS

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SECTION 13222

SECURITY SYSTEM ALARM SYSTEMS

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This Section specifies materials and equipment necessary to complete work for alarm systems without limiting generality thereof includes:

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

Alarm system provides a means of remotely monitoring status of magnetic door contacts, duress alarms, intrusion detection sensors, and other stand alone alarm points as shown on security system drawings. Alarm Annunciation and Monitoring is performed by the intrusion detection/access control computer system. Devices are connected to distributed Remote Terminal Units (RTUs) located throughout the building. These panels in turn report sensor status back to the central computer.

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

Intercoms are to be equivalent to those manufactured by Aiphone.

2.2 EQUIPMENT

Provide equipment and model numbers similar to or equal to those specified, unless noted otherwise. If any item is no longer manufactured notify G-AE in writing, provide data on possible substitutions, and await written approval from G-AE before proceeding with installation of a substitute item.

Provide Ademco Model 269 surface mounted duress switches mounted on underside of table or counter as shown on design drawings.

Provide Sentrol Models RTE1000, AP669, AP633, and 6157 series passive infrared sensors (PIR).

Provide and interconnect tamper switches in all header boxes and enclosures.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Furnish and install devices and interconnect with RTUs.

Furnish and install sensors, duress switches, and PIR alarm sensors as indicated on design drawings.

Provide dedicated low-voltage power for sensors requiring a power supply at locations shown on design drawings.

Device wiring and connection shall conform to manufacturers installation instructions.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

3.3 ADJUSTING, CLEANING, AND INSTRUCTION

Adjust Cameras and Monitors after installation for appropriate viewing field, contrast, and brightness of picture. Test to ensure proper video signal levels.

Clean exposed surfaces and lenses. Touch-up or replace damaged and marred finishes.

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SECTION 13224

VEHICLE BARRIERS AND CONTROLS

06/01

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PART 2 PRODUCTS

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PART 3 EXECUTION

- 3.1 INSTALLATION, GENERAL
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SECTION 13224

VEHICLE BARRIERS AND CONTROLS

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This Section specifies materials and equipment necessary to complete work for vehicle barrier and control system without limiting generality thereof includes.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

Vehicle barrier and control system provides a means of automatically controlling entry and exit of vehicles to and from designated areas. A drop arm barrier in conjunction with a pedestal mounted card reader and buried vehicle sensor loops grant access to the parking area to authorized vehicles while blocking access to non-authorized vehicles. Remote barrier controls are provided to allow operator intervention. Devices are connected to Remote Terminal Units (RTUs) located in security closet. These panels in turn report sensor status back to the central computer and control operation of the barrier. A remote gate controller is installed at

the adjacent guard station to allow manual control the barrier. Intercoms are used with the barriers for intercommunication with the facility.

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

2.2 EQUIPMENT

Provide equipment and model numbers similar to or equal to those specified, unless noted otherwise. If any item is no longer manufactured notify G-AE in writing, provide data on possible substitutions, and await written approval from G-AE before proceeding with installation of a substitute item. Contractor shall submit design drawings of barrier system to coordinate finishes with architectural intent.

Provide drop-arm barrier and operator equivalent to Delta Scientific anti-ram, 30 mile per hour barrier. Barrier must span the driveway.

Provide vehicle loop detectors equivalent to Delta Scientific Model 3965. There shall be one detector for each sensor loop. Detectors shall be mounted by the GC within the enclosures shown on the drawings. Security

contractor shall connect and interface detectors with the integrated intrusion detection/access control system.

Provide wire, cable and conduit for magnetic stripe card reader fitted for exterior operation mounted on a pedestal for easy access by vehicle operators. Pedestal, conduit, and card reader to be installed per the drawings. Wires and cables shall be routed through conduit in the base of the pedestal to the RTU in security closet.

Provide vehicle sensor loops in the roadway . Loops will be located for most efficient operation of the barrier. Loops will be terminated at the detectors located in the barrier cabinet.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Furnish and install conduit and cable from RTU location to each components.

Furnish and install vehicle barrier, controls, and sensor loops as shown on the design drawings

Provide poured in place concrete footing, base, and drop-arm barrier unit and card reader pedestal. Concrete footings shall be constructed in accordance with manufacturers installation instructions. Bases shall be constructed and installed in accordance with the design drawings.

Device wiring and connection shall conform to manufacturers installation instructions.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13236

BACKUP POWER SUPPLY/CHARGER

06/01

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- 1.4 SYSTEM DESCRIPTION
- 1.5 Submittals
- 1.6 GUARANTEE/WARRANTY
- 1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING
- 1.8 QUALITY ASSURANCE
- 1.9 Construction Documents
- 1.10 Operation and Maintenance Data

PART 2 PRODUCTS

- 2.1 PRODUCT QUALITY STANDARDS
- 2.2 EQUIPMENT

PART 3 EXECUTION

- 3.1 INSTALLATION, GENERAL
- 3.2 SYSTEM TEST AND ACCEPTANCE

-- End of Section Table of Contents --

SECTION 13236

BACKUP POWER SUPPLY/CHARGER

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This Section specifies material and equipment necessary to provide uninterrupted power to components of the security systems in referenced sections without limiting generality thereof.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

The Backup Power System is used to supply uninterruptible DC power to selected equipment.

1. The backup power system design shall be in accordance with National Electric Code and shall incorporate UL approved system to provide battery charging and DC power
2. Security devices receive power from building power and backup power supplies located in security closets.
3. Backup power shall be sized for full equipment load plus 50% spare

electrical capacity for future expansion capability.

4. Backup power supplies/chargers shall sized to supply uninterrupted power for eight (8) hours during loss of AC power.

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

2.2 EQUIPMENT

Provide equipment and model numbers similar to or equal to those specified, unless noted otherwise. If any item is no longer manufactured notify G-AE in writing, provide data on possible substitutions, and await written approval from G-AE before proceeding with installation of a substitute item. Contractor shall submit design drawings of barrier system to coordinate finishes with architectural intent.

System Requirements: Provide Altronix AL4000ULX and ALTV244-ULCB or equivalent. Actual size of unit to be based on connected loads. System shall provide 50% spare electrical capacity.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Install backup power supply in accordance with manufacturers installation instructions.

Ground conductor, bonded in accordance with National Electric Code (NEC), shall be installed throughout security equipment power system. Ground shall be installed in a workmanlike manner and extended to all loads. Contractor shall make all connections.

National Electric Code requirements for materials, installation, and application shall be used as criteria for construction of conduit system. Details of conduits are shown in Division 16000.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13238

SECURITY SYSTEM UNINTERRUPTIBLE POWER SUPPLY

06/01

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PART 2 PRODUCTS

- 2.1 PRODUCT QUALITY STANDARDS
- 2.2 EQUIPMENT

PART 3 EXECUTION

- 3.1 INSTALLATION, GENERAL
- 3.2 SYSTEM TEST AND ACCEPTANCE

-- End of Section Table of Contents --

SECTION 13238

SECURITY SYSTEM UNINTERRUPTIBLE POWER SUPPLY

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This Section specifies material and equipment necessary to provide uninterrupted power to components of the security systems in referenced sections without limiting generality thereof.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

The Uninterruptible Power System is used to supply uninterruptible conditioned power to console equipment.

1. The UPS design shall be in accordance with National Electric Code. System shall be isolated, as far as is reasonably possible, from facility's normal power system.
2. Security Systems receive 120VAC power from two sources, Normal building power and UPS power.
3. UPS shall be equipped with an RS-232 port for connection to the Access

Control/Security System to provide UPS status monitoring information.

4. UPS power shall be sized for full equipment load plus 50% spare electrical capacity for future expansion capability.

5. UPS shall be equipped with a manual bypass switch.

6. UPS shall be sized to supply uninterrupted power for 15 minutes during loss of outside power.

7. UPS shall be interconnected with building emergency power.

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

2.2 EQUIPMENT

System Requirements: Provide equipment, engineering, fabrication, labor, installation, wiring, connection, and testing as specified unless otherwise noted. If any item is no longer available notify G-AE in writing, provide data on possible substitutions, and await written approval from G-AE before proceeding with installation of substitute item.

System Requirements: Provide Best FERRUPS 3.1KVA (minimum) unit or equivalent. Actual size of unit to be based on actual site load

requirements. System shall provide 50% spare electrical capacity. Other building systems may be interconnected to UPS. These loads are to be included in size requirements..

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Install UPS in accordance with manufacturers installation instructions.

Provide and install UL listed wire and cable as called for by manufacturer of specific equipment items listed herein. Select wire size to compensate for larger resistive losses associated with long cable runs.

Ground conductor, bonded in accordance with National Electric Code (NEC), shall be installed throughout security equipment power system. Ground shall be installed in a workmanlike manner and extended to all loads. Contractor shall make all connections.

National Electric Code requirements for materials, installation, and application shall be used as criteria for construction of conduit system. Details of conduits are shown in Division 16000.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13240

POWER AND SIGNAL CONDUIT AND WIRING

06/01

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PART 2 PRODUCTS

- 2.1 PRODUCT QUALITY STANDARDS
- 2.2 EQUIPMENT

PART 3 EXECUTION

- 3.1 INSTALLATION, GENERAL
- 3.2 SYSTEM TEST AND ACCEPTANCE

-- End of Section Table of Contents --

SECTION 13240

POWER AND SIGNAL CONDUIT AND WIRING

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This Section specifies material and equipment necessary to interconnect security systems in referenced sections without limiting generality thereof.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

Power, conduit, and wiring system provide signal and power to security system elements. Specific elements are as follows:

1. Power system design shall be in accordance with National Electric Code for security systems. System shall be isolated, as far as is reasonably possible, from facility's normal power system.
2. Security Systems receive 120VAC power from emergency building power.
3. Security systems receive DC power from power supplies/chargers provided by security contractor.
4. Provide each closed circuit television camera with an individual

circuit breaker from building emergency power.

5. For clarity, following terms are defined: a. Power wiring - Conductors operating at 90 volts or greater. b. Signal wiring - Conductors operating at 90 volts or less, conducting discrete electrical signal that are sensitive to electromagnetic interference, and c. Control wiring - Conductors operating at 90 volts or less, conducting electrical signals that are not sensitive to electromagnetic interference.

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

2.2 EQUIPMENT

System Requirements: Provide equipment, engineering, fabrication, labor, installation, wiring, connection, and testing as specified unless otherwise noted. If any item is no longer available notify G-AE in writing, provide data on possible substitutions, and await written approval from G-AE before proceeding with installation of substitute item.

A. System Requirements: Provide wire and cable equal to that as manufactured by Belden Corporation, Electronic Division, PO Box 1980, Richmond, IN 47274 USA. Fiber optic cable shall be equal to that manufactured by Optical Cable Corporation, 870 Harrison Avenue, Salem, VA 24153. All cable runs shall be in EMT or as shown on drawings.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide and install UL listed wire and cable as called for by manufacturer of specific equipment items listed herein. Select wire size to compensate for larger resistive losses associated with long cable runs.

B. Provide conduit extensions necessary to connect power cords and supplies and backboxes for security systems equipment. Conduit fill shall not exceed 30%.

C. Signal and control wire and cable exiting building shall be terminated in patch panel with disconnects for ease of maintenance.

D. Pull and tag wiring between security equipment and patch panels in each closet. Clearly label wiring at both ends, and extend excess wiring 4 meters at termination end and 2 meters at equipment end. All cable runs shall be continuous and without splices. An additional, spare cable of each type shall be pulled in each conduit from header boxes to security closet. A spare pull wire shall be left in every conduit.

E. Ground conductor, bonded in accordance with National Electric Code (NEC), shall be installed throughout security equipment power system. Ground shall be installed in a workmanlike manner and extended to all loads. Contractor shall make all connections.

F. National Electric Code requirements for materials, installation, and application shall be used as criteria for construction of conduit system. Details of conduits are shown in Division 16000.

G. Security system wiring shall be installed in conduit as shown on drawings. Signal and control wiring will not be enclosed in same conduit with power wiring.

H. Device wiring and connection shall conform manufacturers installation instructions and design drawings.

I. Provide cable tray interconnected to building riser as shown on contract drawings.

J. Computers, processors, electronic console equipment, intrusion detection, access monitoring and control equipment, video circuitry, and communication circuits that lead to the central alarm reporting and display unit(s) shall be protected at both ends against lightning strikes and power surges.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13242

SECURITY CLOSET CABINETS AND ENCLOSURES

06/01

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- 1.10 Operation and Maintenance Data

PART 2 PRODUCTS

- 2.1 PRODUCT QUALITY STANDARDS
- 2.2 EQUIPMENT

PART 3 EXECUTION

- 3.1 INSTALLATION, GENERAL
- 3.2 SYSTEM TEST AND ACCEPTANCE

-- End of Section Table of Contents --

SECTION 13242

SECURITY CLOSET CABINETS AND ENCLOSURES

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This Section specifies material and equipment necessary to complete Security Sys-tem Interface Cabinets without limiting generality thereof.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

Cabinets provide a centralized location for installation of barrier strips, coaxial and fiber optic connectors for each cable and wire entering and exiting each security closet.

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

2.2 EQUIPMENT

Provide NEMA Type 12 enclosures as shown on design drawings. Enclosures are to have painted plywood panel inserts and hinged lockable doors.

Provide NEMA Type 4 enclosures for external locations as shown on design drawings. Enclosures are to have painted plywood panel inserts and hinged and padlocked doors.

Provide NEMA junction and backboxes as shown on design drawings.

Provide Series 141 black, phenolic barrier and marker strips. Strips to accommodate #16 AWG wire and to have 6-32 screw binder heads.

Provide BNC type isolated ground bulkhead feed-through connectors for RG-59/U Type coaxial cable.

Provide fiber optic connectors for termination and pass through of all fiber optic cabling.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Provide equipment, labor, fabrication and installation for a completely operational Security System Cable Interface Cabinet as defined herein and as shown on drawings.

Install cabinet and removable mounting panel according to manufacturer's directions.

Install terminal strips, coaxial cable connectors, and cable feed-through devices.

Provide marker strips to identify terminal numbers referenced on run sheets and as-built documentation. Provide number of Bulkhead Connectors to match system requirements.

Install a system ground connected to building ground system.

Device wiring and connection conforms to wiring diagrams provided in system sections.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13244

SECURITY CLOSET RACKS AND CONSOLES

06/01

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PART 2 PRODUCTS

- 2.1 PRODUCT QUALITY STANDARDS
- 2.2 EQUIPMENT

PART 3 EXECUTION

- 3.1 INSTALLATION, GENERAL
- 3.2 SYSTEM TEST AND ACCEPTANCE

-- End of Section Table of Contents --

SECTION 13244

SECURITY CLOSET RACKS AND CONSOLES

06/01

PART 1 GENERAL

1.1 RELATED DOCUMENTS

Contract Drawings and General Provisions of Contract, including CONTRACT CLAUSES AND CONDITIONS, SUPPLEMENTARY CLAUSES AND CONDITIONS, and other Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

This Section specifies material and equipment necessary to complete work for racks and consoles without limiting generality thereof.

Related Specification Sections and Drawings: Following Sections and Drawings contain requirements that relate to this Section:

1. Section 13200 - Technical Security Systems, General
2. Section 13210 - Integrated Intrusion Detection/Access Control/Badging System
3. Section 13214 - Intercoms
4. Section 13220 - Closed Circuit Television System
5. Section 13222 - Alarm Systems
6. Section 13224 - Vehicle Barriers and Controls
7. Section 13236 - Backup Power Supply/Charger
8. Section 13238 - Uninterruptible Power Supply
9. Section 13240 - Power and Signal Conduit and Wiring
10. Section 13242 - Cabinets and Enclosures
11. Section 13244 - Racks and Consoles
12. Division 16000 - Electrical
13. Security System Drawings

1.3 REFERENCES

Specification section 13200 contains references for this section.

1.4 SYSTEM DESCRIPTION

Racks and Consoles provide enclosures for mounting security annunciator, monitoring, and control systems. Standard racks and consoles are used in addition to mill work provided by GC.

1.5 Submittals

Refer to SUBMITTALS and TECHNICAL SECURITY SYSTEMS, GENERAL, for submittal provisions and procedures.

1.6 GUARANTEE/WARRANTY

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Guarantee/Warranty.

1.7 PRODUCT DELIVERIES, STORAGE, AND HANDLING

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for requirements pertaining to Product Delivery, Storage, and Handling.

1.8 QUALITY ASSURANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for quality assurance provisions and procedures.

1.9 Construction Documents

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL, for construction drawing provisions and procedures.

1.10 Operation and Maintenance Data

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for operating and maintenance data provisions and procedures.

PART 2 PRODUCTS

2.1 PRODUCT QUALITY STANDARDS

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for requirements for product quality standards.

2.2 EQUIPMENT

Provide cabinetry and instrument cases similar to those manufactured by Zero Stantron as shown on design drawings. Substitute cabinets meeting design requirements are acceptable.

Provide 6' H X 19" W vertical cabinets for mounting all supplied equipment.

Provide filler panels for cabinets grouped together in order to form an integral unit.

Provide accessories, hardware and mounting strips to accommodate equipment specified and indicated on security system drawings.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

Provide all materials, fabrication, and installation for a completely operational console and equipment rack system, as described herein and shown on design drawings.

3.2 SYSTEM TEST AND ACCEPTANCE

Refer to TECHNICAL SECURITY SYSTEMS, GENERAL for test and acceptance requirements.

-- End of Section --

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DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13451

POWER MONITORING SYSTEM

03/00

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SECTION 13451

POWER MONITORING SYSTEM

03/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.16	(1991) Electricity Metering Solid-State Electricity Meters
ANSI C57.13	(1993) IEEE Standard Requirements for Instrument Transformers.
ANSI C62.61	(1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits
ANSI X3.64	(1979; R 1990) Additional Controls used with ANS Code for Information Exchange

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15	Radio Frequency Devices
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ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA ANSI/EIA/TIA-232-F	(1997) Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
EIA ANSI/TIA/EIA-485-A	(1988) Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multipoint Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 61000-4-5	(1995) Electromagnetic Compatibility (EMC) - Part 4: Testing and Measurement Techniques - Section 5: Surge Immunity Test
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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.90.1	(1989; R 1994) IEEE Standard Surge Withstand Capability (SWC) Tests for
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Protective Relays and Relay Systems

IEEE C62.41

(1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250

(1997) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NEMA ICS 1

(1993) Industrial Controls and Systems

NEMA WC 3

(1992; Rev 1 1994) Rubber-Insulated Wire
and Cable for the Transmission and
Distribution of Electrical Energy

1.2 SYSTEM DESCRIPTION

1.2.1 System Requirements

The power monitoring system, consisting of commercial, off-the-shelf intelligent electronic devices (IEDs), communication channels, and PC-based workstation equipment, will be used to monitor the operation of the main switchboard with the CIL Building at Fort Gillem. The power monitoring system shall be a single workstation system utilizing an Ethernet local area network (LAN). The power monitoring system workstations will be located at the main electrical room.

1.2.2 System Response Times

- a. Any new display shall begin to update the workstation monitor within 2 seconds after being requested. Preformatted displays shall be completely presented within 5 seconds after the request.
- b. All calculated values shall be updated from the database, when displayed at the workstation, at least every 15 seconds.
- c. Digital status indications, when displayed at the workstation, shall be updated within 15 seconds from the IED.
- d. Analog values, when displayed at the workstation. shall be updated within 15 seconds from the IED.

1.2.3 System Accuracy and Display

The system shall maintain the specified end-to-end accuracy from sensor to all workstation displays, including the effects of transmitters, transducers, and engineering units conversions, for one year for the applications specified and shall report and display changes in sensed values as specified. The system accuracy and display requirements are as follows:

- a. Current: with a range for the specific application $\pm 1.0\%$ of reading; display and print to nearest ampere.
- b. Voltage: with a range for the specific application $\pm 1.0\%$ of

reading; display and print to nearest volt.

- c. Power Factor: 1.0% of reading; display and print to nearest hundredth.
- d. kWh: with a range for the specific application $\pm 1.0\%$ of reading; display and print to nearest kWh.
- e. KW: with a range for the specific application $\pm 1.0\%$ of readings.
- f. KVA: with a range for the specific application $\pm 1.0\%$ of reading; display and print to nearest KVA.
- g. KR: with a range for the specific application $\pm 1.0\%$ of reading; display and print to nearest KR.
- h. Frequency: ± 0.05 Hz; display and print to nearest 0.1 Hz.
- i. Total Harmonic Distortion (THD) in percent for current and voltage, each phase.
- j. K-Factor (dimensionless ratio based on harmonic content of current waveform).
- k. Special application(s) added by the designer, as needed.

1.2.4 Environmental Requirements

- a. Workstation and associated equipment shall operate without damage or degradation under the following ambient conditions, unless otherwise noted.
 - (1) Operating Temperature: 16 to 29 degrees C .
 - (2) Operating Humidity: 20 to 80 %, non-condensing.
- b. All field equipment shall operate without damage or degradation under the following ambient conditions, unless otherwise noted.
 - (1) Operating Temperature: 0 to 50 degrees C .
 - (2) Operating Humidity: 10 to 90 %, non-condensing.

1.2.5 Electrical Transients and Electromagnetic Interference

1.2.5.1 Power Line Surge Protection

Workstation equipment connected to ac circuits shall be protected from power line surges and meet the requirements of IEEE C62.41 location category A3, while equipment is operating. In addition, all IEDs shall be protected to meet the requirements of IEEE C37.90.1 or the requirements of IEC 61000-4-5, test level 4, while the equipment is operating. Fuses shall not be used for surge protection.

1.2.5.2 Sensor Wiring Surge Protection

All digital and analog inputs of all IEDs shall be protected against surges induced on sensor wiring to meet the requirements of IEEE C37.90.1 or the requirements of IEC 61000-4-5, test level 4, while the equipment is operating. Fuses shall not be used for surge protection.

1.2.5.3 Communications Channels Surge Protection

Communications equipment shall be protected against surges induced on its communications channels. Communication interfaces to all field equipment shall be protected to meet the requirements of IEEE C37.90.1 or the requirements of IEC 61000-4-5, test level 4, while the equipment is operating. Fuses shall not be used for surge protection. Metallic cables and conductors which serve as communications channels between buildings shall have surge protection installed at equipment and additional triple electrode gas surge protectors rated for the application installed at each end, within three feet of the building cable entrance. Surge protectors shall meet the requirements of ANSI C62.61.

1.2.6 Workstation Equipment Power Source

Workstation equipment shall be powered from an uninterruptible power supply (UPS) as shown. The UPS shall provide 15 minutes of normal operation for all connected equipment.

1.2.7 Communications

The Workstation shall be configured to accept a minimum of 4 EIA ANSI/EIA/TIA-232-F or EIA ANSI/TIA/EIA-485-A data communications channels by way of communication interface converters. Each communication channel shall support communication with at least 30 IEDs and shall meet the performance requirements as specified.

1.2.8 Expansion Requirements

The Contractor shall provide Workstation hardware and software to accommodate a total of 120 IEDs.

1.2.9 Protocols

The workstation equipment shall include software allowing it to communicate with field equipment using any of the following protocols:

- a. A published open protocol.
- b. MODBUS RTU/ASCII.

1.2.10 Utility Demand Interval Synchronization

An interface for utility demand interval synchronization signals shall be provided as shown. The synchronization signal shall be used in calculating and displaying demand.

1.3 SUBMITTALS

Government approval is required for submittals with a "G, AE" designation; submittals not having a "G, AE" designation are for information only. When used, a designation following the "G, AE" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Data, Drawings, CD-ROMs, and Manuals; G, AE

All items of software and technical data (including technical data which relates to computer software), which is specifically identified in this specification shall be delivered strictly in accordance with the CONTRACT CLAUSES and the Contract Data Requirements List, DD Form 1423. All data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. All drawings submitted shall be in DXF and MicroStation v5.0 file structure. Five sets of CD-ROMs shall be provided after final drawings are approved. Manuals provided shall contain the minimum content specified, although varied packaging and formats are acceptable. The Contractor may submit standard manuals with additions as necessary to conform to the requirements listed below.

Technical Data Package 1 - Existing Conditions Report; G, AE

The data package shall include the existing conditions report as specified in Paragraph: Existing Conditions Survey, and associated documentation as specified.

SD-03 Product Data

System and Installation Drawings; G, AE

- a. Power monitoring system block diagram.
- b. Layout plans showing equipment locations and cable routing.
- c. Field equipment installation drawings including dimensional drawings of any existing enclosures showing equipment cutouts and mounting locations, and indicating adequate clearance from existing wiring and devices per manufacturer's recommendations.
- d. Instrument transformer wiring and installation drawings.

Equipment Data; G, AE

A complete data package shall be delivered for all materials and equipment as specified, including the following:

- a. Catalog data for workstation equipment demonstrating compliance with specified requirements.
- b. Catalog data for field equipment indicating outline and

mounting dimensions and schematic external wiring arrangement, and

c. Catalog data for instrument transformers demonstrating compliance with specified requirements.

Installation, Setup and Operation Guides; G, AE

The data package shall include the manufacturer's standard installation, setup and operation guides for workstation equipment and field equipment, and shall include details of the published open protocol for communications.

User's Guides G, AE

The data package shall include the manufacturer's standard user's guides for all software provided with the system.

SD-07 Certificates

Component Compliance; G, AE

The Contractor shall provide written certifications that system components meet the requirements specified including:

- a. 47 CFR 15
- b. IEEE C62.41
- c. ANSI C12.16
- d. ANSI C62.61
- e. IEEE C37.90.1 or IEC 61000-4-5.

SD-08 Manufacturer's Instructions

Lesson Plan; G, AE

Lesson plans and training manuals for the training phases, including type of training to be provided and with a list of reference material shall be submitted for approval as specified.

SD-06 Test Reports

Procedures; G, AE

The Contractor shall submit test procedures for the Performance Verification Test (PVT). The test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the requirements of this specification. The Contractor shall submit the PVT procedures for approval.

Performance Verification; G, AE

The Contractor shall submit the performance verification test data to the Government after the Government approves the performance verification test.

SD-10 Operation and Maintenance Data

O&M Manual; G, AE

The operation and maintenance manuals shall consist of a resubmission of all technical data identified as Technical Data Package 2, bound in three-ring binder, with as-built corrections and revisions and with addenda/appendices as necessary to identify any special characteristics or operations not covered in the manufacturer's standard documentation. The Contractor shall submit 6 copies of the operation and maintenance manuals within 30 days following successful completion of the PVT.

1.4 TESTING

1.4.1 General Requirements for Testing

The Contractor shall perform testing of the workstation and field equipment, at the site, including adjustments of the completed system as specified. The Contractor shall provide all personnel, test equipment, instrumentation, and supplies necessary to perform all testing. Written notification shall be given to the Government at least 21 days prior to the PVT, and in no case shall notice be given until after the Contractor has received written Government approval of the specific testing procedures.

1.4.2 Test Procedures and Reports

The procedures shall consist of detailed instructions for test setup, execution, and evaluation of test results. The test reports shall be used to document results of the tests. Reports shall be delivered to the Government within 7 days after completion of test.

1.5 MAINTENANCE AND SERVICE

1.5.1 General Requirements

The Contractor shall provide all maintenance services required and equipment necessary to maintain the entire system operational, as specified, for a period of 1 year after system acceptance. Maintenance shall include preventive maintenance in addition to repairs, replacements, and adjustments and software updates. Written permission shall be obtained from the Government prior to performing any service work or adjustments which have any impact on facility operations.

1.5.2 Description of Work

The adjustment and repair of the system includes all workstation equipment and field equipment including software updates. Contractor shall perform each manufacturer's required adjustments and all other work necessary for proper operation as specified.

1.5.3 Service Calls

The Government will initiate service calls when the system is not functioning properly. The Government shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at the site within three working days after receiving a

request for service. The system shall be restored to proper operating condition within seven working days after receiving a request for service.

1.5.4 Records and Logs

The Contractor shall keep records and logs of each maintenance and service task, and shall organize cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for all devices on a site-by-site basis. The log shall contain all initial analog span and zero calibration values and testing of all digital points. Complete logs shall be kept and shall be available for inspection onsite, demonstrating that planned and systematic adjustments and repairs have been accomplished for the system. The Contractor shall provide the Government with a summary report of the maintenance and service performed during each previous month.

1.5.5 System Modifications

The Contractor shall make any recommendations for system modification as part of maintenance and service in writing to the Government. No system modifications, including operating parameters and control settings, shall be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the system documentation including drawings and manuals.

1.5.6 Software

The Contractor shall provide notices of all software updates and verify operation in the system, if the Government chooses to incorporate the update. These updates shall be accomplished in a timely manner, fully coordinated with system operators, and shall be incorporated into the manuals and software documentation. The Contractor shall install and validate the latest released version of the software, upon receiving written approval by the Government.

1.5.7 Telephone Consultation

The Contractor shall provide up to 40 hours per year of telephone consultation to Government personnel. The Contractor shall keep a log by month, identifying caller, date and length of call, and results of call.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 General

Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, with model and serial number in a conspicuous place. All materials and equipment shall be currently in production at time of delivery to the Government.

2.1.2 Nameplates

Laminated plastic nameplates shall be provided for each equipment enclosure and device furnished. Laminated plastic shall be 3 mm thick, white with black center core. Nameplates shall be a minimum of 25 by 75 mm , with minimum 6 mm high engraved block lettering. Nameplates for devices smaller than 25 by 75 mm shall be attached by a non-ferrous metal chain. All other nameplates shall be attached to the device. The nameplate for each equipment enclosure or device shall include the designator or number as shown, and the site name. Site names shall be provided after order placement. Nameplates shall be attached to the equipment with stainless steel panhead screws.

2.1.3 Field Wiring, Cabling, and Terminal Blocks

- a. Internal wiring in factory pre-wired enclosures shall be installed according to the Contractor's standard as to wire size, insulation, and method of termination on internal equipment. The individual conductors of the interconnecting cables shall meet the flame resisting test requirements of NEMA WC 3. Each individual conductor in individual enclosures shall be uniquely identified in accordance with NEMA ICS 1. Splices shall not be permitted.
- b. Rail mounted compression clamp terminal blocks shall be provided for conductors requiring connection to circuits external to the specified equipment, and shall be suitable for up to 12 AWG wire. Terminal blocks for analog circuits shall be knife switch disconnecting type. Terminal blocks shall be grouped for easy accessibility unrestricted by interference from structural members and internal devices. Sufficient space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block. Plastic wiring duct or other factory mounted cable support devices shall be provided to support cables for external circuit wiring.
- c. Terminal blocks, interposing relays, switches, or similar devices shall be readily accessible. The equipment shall be located in compartments, enclosures, or junction boxes in such arrangement that maintenance personnel shall have direct access to the equipment without removal of barriers, cover plates, or wiring. Grouped terminal blocks for all external connections shall be provided. All wiring leaving an enclosure shall leave from terminal blocks or prefabricated connectors and not from other devices in the enclosure. Terminal blocks and jumpers shall be permanently and uniquely marked in conformance with NEMA ICS 1.

2.1.4 Power Supplies

Field equipment shall be powered from 120 Vac or shall derive power from the monitored circuit.

2.1.5 Enclosures

Enclosures shall conform to the requirements of NEMA 250 for the types specified. Damaged surfaces shall be repaired and refinished using original type finish. Enclosures installed outdoors shall be type 4X stainless steel, unless otherwise shown, and shall contain a thermostatically controlled space heater to maintain the enclosure above

the dew point, if required by the equipment installed. Enclosures shall have removable hinged, key-locked front doors. All enclosure locks shall be keyed alike. A total of 5 keys shall be turned over to the Government.

2.1.6 EMI/RFI Compliance

Equipment shall be designed to minimize the generation of electromagnetic and radio frequency interference. Workstation equipment shall be in compliance with 47 CFR 15, for Class B computing devices.

2.2 FIELD EQUIPMENT

2.2.1 Basic Intelligent Electronic Device (IED)

2.2.1.1 Basic IED

Basic IEDs shall be microprocessor based devices providing multiple measurements for 60 Hz single phase or three phase electric systems as shown. Basic IEDs shall utilize a communication protocol in accordance with Paragraph: Protocols for display and transmission of the following parameters as specified plus other parameters as shown:

Voltage line-to-neutral plus or minus 0.5%
Voltage line-to-line: plus or minus 1%
Current: plus or minus 0.5%
kVA: plus or minus 1%
kVAR: plus or minus 1.5%
Power factor: plus or minus 1%
kW: plus or minus 1.5%
kWh: plus or minus 1.5% of reading

2.2.1.2 Mounting

Basic IEDs shall accommodate mounting in or on switchgear enclosures as required for the installation.

2.2.1.3 Communications

- a. Basic IED to workstation: Communications interfaces shall be provided for each Basic IED to the communications channels for data transfer between Basic IED and workstation.
- b. Each Basic IED shall have ports and modems or line drivers to perform the specified functions.

2.2.1.4 KWH Value Retention

Basic IEDs shall retain the accumulated KWH value for 72 hours minimum during power outages.

2.3 INSTRUMENT TRANSFORMERS

2.3.1 Potential Transformers

Potential transformers shall be compatible with IEDs furnished. The Contractor shall be responsible for determining the actual voltage ratio of each transformer. Potential transformers shall conform to ANSI C57.13 and the following requirements.

Type: indoor, dry type, of two-winding construction
Frequency: Nominal 60Hz
Accuracy: plus or minus 0.3% at 60Hz

2.3.2 Multi-Ratio Current Transformers

Current transformers shall be compatible with the IEDs furnished. Current transformers shall conform to ANSI C57.13 and the following requirements.

Insulation Class: BIL rating shall be equal or greater than the equipment being connected to.
Frequency: Nominal 60Hz
Accuracy: plus or minus 0.3% at 60Hz
Burden: Burden class shall be selected for the load
Phase Angle Range: 0 to 60 degrees

2.4 WORKSTATION EQUIPMENT

2.4.1 Workstation Computer

2.4.1.1 Digital Computer

The workstation computer shall function as the overall system coordinator, perform automated functions, and perform calculations associated with operator interactions, alarm reporting, and logging of events. Each workstation computer shall be a single manufacturer's standard unmodified digital computer of modular design. The workstation computers shall not include any hardware precluding the purchase of a standard maintenance and service contract from the computer manufacturer. Each workstation computer shall have at least a 400 MHz processor and a 32 bit data and address bus:

2.4.1.2 Memory

Each workstation computer shall be provided with 128 megabytes RAM as a minimum, expandable to 512 megabytes.

2.4.1.3 Hard Disk Drive Data Storage

Each workstation shall be provided with a hard disk drive system. Each hard disk drive system shall include at least one drive and controller. Formatted drive capacity shall be not less than 8 gigabytes, and average access time shall not be greater than 10 milliseconds. Automatic read-after-write checking shall be provided.

2.4.1.4 Floppy Disk Drive

Each workstation computer shall have a 1.44 megabyte 89 mm floppy disk drive and controller.

2.4.1.5 CD-ROM Drive

A 32X CD-ROM drive having a nominal storage capacity of 650 megabytes and a minimum 128 kilobyte cache memory shall be provided for each workstation computer.

2.4.1.6 Workstation Computer Magnetic Tape Drive

Each workstation computer shall have a 4 mm Magnetic Tape Drive with a formatted uncompressed storage capacity of 4 gigabytes and formatted compressed storage of 8 gigabytes.

2.4.1.7 Workstation Color Monitors

- a. Workstations shall include a color monitor with a tilt/swivel base and local controls for contrast, brightness, focus, vertical size, horizontal size, vertical position, and horizontal position.
- b. A graphics adapter shall be furnished, with four megabyte (minimum) of video memory, supporting all video modes and resolutions specified.
- c. The color monitors shall be nominal 508 mm (20 inch) , with 0.26 to 0.28 mm dot pitch.

2.4.1.8 Keyboard

Each workstation shall have a keyboard provided with the system. The keyboard shall comply with the ANSI X3.64 standard and shall include a typewriter arrangement of alphanumeric symbols, vertical and horizontal tab keys, a standard numeric pad, cursor direction controls with a home key, and 10 user assignable push-button keys.

2.4.1.9 Mouse

The Contractor shall provide a standard mouse with each workstation. Mouse speed and resolution shall be adjustable.

2.4.1.10 Audible Alarm

Each workstation shall include an audible alarm, actuated by the on-line workstation computer.

2.4.1.11 Laser Printer

Each workstation shall be provided with a laser printer. Resolution shall be a minimum of 600 dots per inch and there shall be a minimum of 2 megabytes RAM. Printing speed shall be a minimum of eight pages per minute, with a 100-sheet minimum paper cassette and with manual feed. A parallel interface shall be provided for connection to the workstation computer.

2.4.2 Communications

Communications channels for the IEDs shall be provided as shown. The workstation shall include communication channels as required, expandable as specified with additional cards. Data transfer shall be set at 9600 bps per channel. Repeaters and modems shall be provided as shown or required.

2.5 SYSTEM SOFTWARE

The standard system software supplied by the computer system manufacturer shall not be modified in any way that would preclude purchase of a standard maintenance and service contract from the computer manufacturer. A currently available and supported windowing disk operating system and graphical user interface shall be utilized.

2.6 COMMAND SOFTWARE

2.6.1 General Features

Command software shall be provided and shall request, receive, and process all real-time values acquired from periodic scans of field equipment and manual data and command entries from operator workstations. The software shall effectively coordinate the field equipment scanning and database updating with the workstation interface, report and event software, and other related calculation and data processing software.

2.6.2 Database Management

2.6.2.1 Real-Time Database

- a. A real-time database shall be provided to store and manage the most current calculated, and scanned values.
- b. The real-time database shall be designed to handle the total number of IEDs specified in paragraph EXPANSION REQUIREMENTS.

2.6.2.2 Database Editor

The database editor shall enable the operator to add, modify, and delete system IED's via interactive procedures. The editing software shall dynamically resize tables and files as IEDs are added or deleted. The system shall provide "fill-in-the-blank" displays for editing.

2.6.2.3 Calculated Value

This value shall be created by calculating it from any combination of monitored values and parameters, and other data. The results of the calculation will be a value having all the properties of monitored values without the associated hardware. The calculated point shall be available for use in any display or report.

2.6.3 Scanning

- a. The software shall provide the message exchange sequence for scanning, generate necessary commands to retrieve monitored values and parameters, and perform all required error checking to ensure

validity of received data, and/or proper completion of the scan sequence. All system malfunctions, including no response from field equipment, incomplete data, or invalid data, shall be reported.

- b. The Workstation shall communicate with IEDs on a sequential continuous scan basis.
- c. Inclusion or exclusion of any IED from the scanning sequence shall be accomplished from any Workstation.

2.6.4 Error Detection and Retransmission

An error detection algorithm shall be used for data between IED and workstation which shall detect all single and double bit errors, all burst errors of eight bits or less, and at least 99% of all multi-bit and burst error conditions. A message shall be in error if one bit is received incorrectly. The system shall retransmit all messages with detected errors.

2.6.5 User Interface Software

2.6.5.1 General Display Requirements

Displays shall be provided as specified and shown. All displays shall be uniquely labeled. All displays shall include time and date. Displays shall contain any combination of graphic and tabular information. A display shall contain any combination of monitored data from all IEDs, and all displayed data shall be updated as specified in Paragraph: System Response Times.

2.6.5.2 Display Editor

The display editor shall enable an operator with proper password to create, modify, and delete displays. The primary use shall be for adding and modifying one-line diagrams, station status displays, system summaries, and system directories, as field equipment or new data are added.

2.6.5.3 Specific Displays

The contractor shall provide the following graphic and tabular displays:

- a. System Menu (menu of all tabular, reports, graphical displays, active trends, and other displays provided on the system). Hot buttons shall be provided to allow an operator with an appropriate password, to select and go to any display from this index.
- b. Station Index (a list of all IEDs). Hot buttons shall be provided to allow an operator to select and go to the graphic displays and tabular displays for the selected IED.
- c. Site index (a list of sites such as substations or switching stations). Hot button shall be provided to allow an operator to select and go to the graphic displays and tabular displays for the selected site.

- d. Graphic displays based on the information shown.

2.6.6 System Access Control

A minimum of 32 passwords shall be usable with the system software. The system shall include software security provisions to prevent inadvertent or unauthorized change of the password. The password shall not be displayed or printed.

2.6.7 Trending

2.6.7.1 Software General Requirements

- a. The trending software shall maintain data files for a minimum of 64 data trends. Any monitored or calculated value shall be trendable. Each data trend file shall retain a minimum of 500 data samples. The time rate of sampling shall be selectable on an individual trend basis. The data files shall be maintained with new data "pushed" in and the oldest data overwritten.
- b. The monitor shall display at least four trend values per window with separately selectable amplitude scales and time scales for each window. The time line programming shall allow for time scale references to be presented in a visual format that is representative of the application. As each new data line is written on the display, all previous entries shall be advanced to the next sequential element position. Time lines shall automatically move with each data point such that the time reference is always correct.
- c. An operator shall be able to enter upper and lower limits for each trend.
- d. The system shall provide for dynamic line and bar graphs, illustrating an analog value through a horizontal or vertical bar. The color of the bar graph shall be user-specified.
- e. The trending software shall allow at least eight colors to be used for different trends.
- f. The trending system shall include indication of alarm conditions.
- g. The system shall support the presentation of data with time on the X-axis (horizontal) and amplitude on the Y-axis (vertical). A minimum of 24 1-hour divisions and 31 1-day divisions shall be displayed on the X-axis. The start and end date/time shall be operator definable.

2.6.7.2 Trend Description Fields

Each trend display shall include the following trend user-definable description fields.

- a. Variable name

- b. Amplitude scale
- c. Amplitude designation (engineering units)
- d. Time units per division

2.6.7.3 Trend Functions

The trending system software shall support the following trend functions.

- a. Trend data from history file without active update.
- b. Trend data with active update and trend history from time of request to present (no prior history).
- c. Trend data with active update and with prior history from a trend history file.

2.6.7.4 Storage of Trend Files

A user shall be able to select any combination of trend files for storage on hard disk. The files shall be automatically saved after a user-selectable number of trend values.

2.6.8 Report Generator

2.6.8.1 Required Software Features

Software shall be provided with commands to generate and format both tabular and graphical reports (including bar charts, pie charts and curve plots) for displaying, printing, and storing on hard disk. Reports shall be stored by type, date, and time. The destination of each report shall be selectable by the user. Reports shall use database dynamic values and parameters, values calculated using the database, and reports stored on disk or tape. Reports shall be spooled allowing the printing of one report to be complete before the printing of another report commences. Parameters used in reports shall be assignable by the user. Reports shall be processed to avoid interference with normal workstation computer tasks. The report shall contain the time and date when the sample was taken, and the time and date when the report was printed. Reports shall be user-definable to show information in the system database. The system shall allow for the operator to request an immediate printout of any report at any time.

2.6.8.2 Creation of Reports

- a. Status Report: The system shall include software to produce reports on the current status of any equipment or parameters in the data base, including:
 - 1. An individual IED.
 - 2. A list of equipment or monitored values, by category, such as substation, building, unit, and type of monitored value.
- b. Profile Reports: The software shall provide for generating

profile reports by sampling and storing defined parameters on an operator assignable and selectable time interval basis such as an interval of 15 minutes for a period of 1 month and shall include:

1. Power consumption (value vs. time).
2. Average power demand (value vs. time).
3. Equipment subsystem profiles (value vs. value or value vs. time).
4. Provide for 32 profile reports each having up to 1000 samples of up to 8 parameters.

2.6.8.3 Standard Reports

The following standard reports shall be provided:

a. Electrical Power Utilization Report: An electrical power utilization summary, user selectable for individual meters or transducers, any group of meters or transducers, and all meters or transducers on a daily and a monthly basis. The report shall include:

- (1) Total daily kWh consumption.
- (2) Total monthly kWh consumption for period beginning on user selectable day of the month.
- (3) Demand interval kWh peak for the month and day, with time of occurrence.
- (4) kWh consumption over each demand interval.
- (5) Average kW demand during the interval containing the utility company's peak demand.
- (6) Average kW demand during the interval containing the base's peak demand.
- (7) Time-of-use peak, semi-peak, off-peak, or baseline total kWh consumption.

b. Alarm Report: All current alarms or all alarms occurring within a user-specified period by IED, building, substation, installation, and the entire system, including time of occurrence.

c. Analog Limit Report: An analog limit and differential summary selectable to describe a single analog value, all analog values within an IED, all analog values within a building, and all analog values for the project.

- (1) Analog value.
- (2) Engineering units.
- (3) High limit.
- (4) Low limit.
- (5) Analog value change differentials.

d. Static Database Reports: A listing of the values of fixed parameters and constraints defining the characteristics of the

system. Provide operator commands to list the entire static database or to list an operator selected building, substation, unit, or IED. Each value listed shall be identified in English.

- e. Real-Time Database Reports: A list of the values of dynamic variables including all measured values and calculated values. These variables shall include year, month, day, hour, and minute on the report. Operator commands shall allow for listing the entire real-time database or to list a user selected building, substation, unit, or IED. Each value listed shall be identified in English.

2.6.9 Alarm Processing

The alarm processing software shall recognize excursions of monitored or calculated values beyond operator assigned limits. Alarms shall be stored in the database and shall be retrieved for display or reporting as alarms.

2.6.10 Historical Data Processing

2.6.10.1 System General Requirements

The system shall process all real-time values and store user-selectable values for use at a later time. It shall store scanned values on a periodic basis, the maximum value for a point which occurred within a given time, or a calculated value. It shall generate reports using the historical data base processor and the reporting software. All historical information shall initially be stored. The tape drives shall store data in a form that allows historical reports to be readily prepared from the media. Historical trend files saved to the tape drives shall be recallable both as a trend file and as tabular data. All historical data shall be written to appropriately structured files on the workstation computer's hard drive, which shall function as a 30-day buffer. After the 30-day period is over, the system shall prompt the operator to archive the data to tape.

2.6.10.2 DDE Data Export

Software shall be provided to implement Dynamic Data Exchange (DDE) for export of historical data to an Excel spreadsheet or other application. Data shall be stored in an Open Data Base Connectivity (ODBC) compliant format.

2.7 FIELD EQUIPMENT SOFTWARE

The Contractor shall provide software necessary to accomplish the following functions, fully implemented and operational, within the field equipment.

- a. Scanning of inputs.
- b. Averaging or filtering of inputs.
- c. Display of values.
- d. Report to workstation of values.
- e. IED diagnostics.

2.8 INITIAL STOCKS

The contractor shall furnish the stocks as specified below. All initial quantities shall be in addition to those needed for running the PVT.

- a. One box of 10-3.5" 1.44 MB diskettes for each Workstation.
- b. One toner cartridge for each laser printer.
- c. Ten new 4 mm formatted tapes with a capacity of 4 Gbytes before compression.

2.9 COMMUNICATIONS CHANNELS

The Contractor shall provide communications channels as shown between the IEDs and workstations as specified in Sections 16768 FIBER OPTIC DATA TRANSMISSION SYSTEM and 16792 WIRE LINE DATA TRANSMISSION SYSTEM. The Contractor shall use Government-furnished communications channels where shown.

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor may start installation after Government acceptance of the Technical Data Packages 1 and 2.

3.1.1 Existing Condition Survey

The Contractor shall connect to and utilize existing devices as shown. Devices that are usable in their original configuration without modification may be reused. The Contractor shall perform a field survey, including inspection of all existing devices intended to be incorporated into the system and furnish an existing conditions report to the Government. The report shall identify those items considered nonfunctioning. The Contractor shall provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. If a device fails after the Contractor has commenced work on that device, the Contractor shall diagnose the failure and report the failure to the Government. The Contractor shall be held responsible for repair costs due to Contractor negligence or abuse of Government equipment.

3.1.2 Scheduling of Work and Outages

The Contract Clauses shall govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.

3.1.3 Demolition and Removal

Required work shall be in accordance with Section 02220 DEMOLITION and the Contract Clauses.

3.1.4 Installation of Field Equipment

3.1.4.1 Installation General Requirements

The Contractor shall install all field equipment as specified and required for a fully functional and operational system. The Contractor shall exercise caution when drilling holes in panels housing energized equipment.

When mounting field equipment, the Contractor shall not allow metal shavings to fall into energized equipment. All work related to power equipment, including installation of instrument transformers on high voltage equipment and feeders, shall be as required in Sections 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL, 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND, and 16415 ELECTRICAL WORK, INTERIOR.

3.1.4.2 Grounding

The Contractor shall provide grounding in accordance with manufacturer's recommendations and as specified. The Contractor shall provide an adequate ground for all enclosure circuits and cable shields to prevent ground loops and electrical noise from adversely affecting operation of the system.

3.1.4.3 Communications Equipment

The Contractor shall be responsible for installing and testing communications equipment.

3.1.5 Installation of Workstation Equipment

The Contractor shall install all Workstation and peripheral equipment as specified and shown for an operational system.

3.1.6 Installation of Current Transformers

Each terminal of each current transformer shall be connected to a short circuiting terminal block.

3.1.7 Installation of Software

3.1.7.1 General

The Contractor shall install all software as specified and required for an operational system including databases, operational parameters, LAN, system, command, application, and Workstation programs. Upon successful completion of the PVT, the Contractor shall provide original and backup copies of object modules for all accepted software including diagnostics, on each type of media utilized. The hard drive on each workstation shall be partitioned and formatted at the factory, and all workstation software shall be installed on the hard drive at the factory. The Contractor shall provide one master copy and one back-up copy of all software, including the operating system, on CD-ROM.

3.1.7.2 Development of Database

The Contractor shall develop the entire system database, using data shown, and the Contractor shall supply all other data required for the database.

3.1.7.3 Displays Required

The Contractor shall provide the displays specified and as shown. All real-time inputs for the displays shall be included. All graphics provided shall be in the format and meet the requirements of paragraph USER INTERFACE SOFTWARE.

3.2 SITE TESTING

3.2.1 General

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Government will witness all PVT testing. Original copies of all data produced, including results of each test procedure, during the PVT shall be turned over to the Government prior to approval of the test.

3.2.2 Field Testing

The Contractor shall test, adjust, and calibrate all field equipment and verify system communications before the system is placed on line. The Contractor shall verify operation of all systems as specified upon loss of power, and that all systems return to proper operation automatically upon resumption of power. The Contractor shall deliver a report describing results of functional tests, diagnostics, and system calibrations including written certification to the Government that the installed complete system has been tested, adjusted, and calibrated, and is ready to begin the PVT. The report shall also include a copy of the approved PVT procedure.

3.2.3 PVT

The Contractor shall demonstrate compliance of the completed system with the contract documents. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The PVT as specified shall not be started until after receipt by the Contractor of written permission by the Government, based on the Contractor's written report including certification of successful completion of Contractor's Field Testing as specified, and upon successful completion of training as specified. The PVT shall be performed as an integrated test with the data transmission system, and with all equipment specified operating and exchanging actual data under fully loaded conditions.

3.3 TRAINING

3.3.1 General

The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the system as specified. The training shall be oriented to the specific system being installed under this contract. Training manuals shall be delivered for each trainee with two additional copies delivered for archival at the project site. The Contractor shall furnish all audiovisual equipment and all other training

materials and supplies. Where the Contractor presents portions of the course material by audiovisuals, copies of those audiovisuals shall be delivered to the Government either as a part of the printed training manuals or on the same media as that used during the training sessions. A training day is defined as eight hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor shall assume that attendees have a high school education or equivalent, and are familiar with utility systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

3.3.2 Operator's Training I

The first course shall be taught at the project site for a period of two consecutive training days during or after the Contractor's field testing, but before commencing the PVT. A maximum of 6 personnel will attend the course. No part of the training given during this course shall be counted toward completion of the PVT. The course shall include instruction on the specific hardware configuration of the installed system and specific instructions for operating the installed system. Upon completion of this course, each student shall be able to start the system, operate the system, recover the system after a failure, and describe the specific hardware architecture and operation of the system. This course shall include:

- a. System architecture.
- b. Functional operation of the system.
- c. User commands.
- d. Display generation.
- e. Database entry.
- f. Reports generation.
- g. Diagnostics.
- h. LAN operation, if required.

3.3.3 Operator's Training II

The second course shall be taught at the project site for a period of one training day approximately one month after completion of the PVT. The Government will determine the specific date of the training session. A maximum of 6 personnel shall attend the course. The course shall be structured to address specific topics that the students need to discuss and to answer questions concerning the operation of the system. Upon completion of the course, the students should have no unanswered questions regarding operation of the installed system.

3.3.4 Maintenance Training

The maintenance course shall be taught at the project site within thirty days after completion of the PVT for a period of two training days. A maximum of 6 personnel will attend the course. The training shall include:

- a. Physical layout of each piece of hardware.
- b. Troubleshooting and diagnostics procedures.
- c. Repair instructions.

- d. Preventive maintenance procedures and schedules.
- e. Calibration procedures.

-- End of Section --

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SECTION 13851A

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08/98

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SECTION 13851A

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S3.41 (1990; R 1996) Audible Emergency
Evacuation Signals

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15 Radio Frequency Devices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a (2001) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 72 (1999) National Fire Alarm Code

NFPA 90A (1999) Installation of Air Conditioning
and Ventilating Systems

NFPA 1221 (1994) Installation, Maintenance and Use
of Public Fire Service Communication
Systems

UNDERWRITERS LABORATORIES (UL)

UL 6 (1997) Rigid Metal Conduit

UL 38 (1994; Rev Nov 1994) Manually Actuated
Signaling Boxes for Use with
Fire-Protective Signaling Systems

UL 228 (1997) Door Closers-Holders, With or
Without Integral Smoke Detectors

UL 268 (1996; Rev thru Jun 1998) Smoke Detectors

for Fire Protective Signaling Systems

UL 268A	(1998) Smoke Detectors for Duct Applications
UL 464	(1996; Rev May 1997) Audible Signal Appliances
UL 521	(1993; Rev Oct 1994) Heat Detectors for Fire Protective Signaling Systems
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 864	(1996) Control Units for Fire-Protective Signaling Systems
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 1971	(1995; Rev thru May 1997) Signaling Devices for the Hearing Impaired

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Fire Alarm Reporting System; G, REA/~~E~~.

Detail drawings, prepared and signed by a Registered Professional Engineer or a NICET Level III Fire Alarm Technician, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The Contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level III Fire Alarm Technician showing points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

SD-03 Product Data

Storage Batteries; G, REA/~~E~~.

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop; G, REA/E.

Voltage drop calculations for notification appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Special Tools and Spare Parts; G, REA/E.

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Technical Data and Computer Software; G, REA/E.

Technical data which relates to computer software.

Training; G, REA/E.

Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

Testing; G, REA/E.

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level III Fire Alarm Technician, for the fire detection and alarm system 14 days prior to performing system tests.

SD-06 Test Reports

Testing; G, REA/E.

Test reports, in booklet form, showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results and indicate the final position of controls. The Contractor shall include the NFPA 72 Certificate of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

SD-07 Certificates

Equipment; G, REA/E.

Certified copies of current approvals or listings issued by an

independent test lab if not listed by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Qualifications; G, ~~REA/E~~.

Proof of qualifications for required personnel. The installer shall submit proof of experience for the Professional Engineer, fire alarm technician, and the installing company.

SD-10 Operation and Maintenance Data

Technical Data and Computer Software; G, ~~REA/E~~.

Six (6) copies of operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features. Six (6) copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements. Original and backup copies of all software delivered for this project shall be provided, on each type of media utilized. Manuals shall be approved prior to training.

1.3 GENERAL REQUIREMENTS

1.3.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours of notification.

1.3.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.3.3 Keys and Locks

Locks shall be keyed alike. Four keys for the system shall be provided.

1.3.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.3.5 Verification of Dimensions

After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3.6 Compliance

The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer. The equipment furnished shall be compatible and be UL listed, FM approved (FM P7825a), or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.3.7 Qualifications

1.3.7.1 Engineer and Technician

a. Registered Professional Engineer with verification of experience and at least 4 years of current experience in the design of the fire protection and detection systems.

b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET Level III certificate.

c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.3.7.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level III Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level II or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level I Fire Alarm Technician shall install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.3.7.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

- a. An engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.
- b. A registered professional engineer (P.E.) in fire protection engineering.
- c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.

- d. An engineer with a minimum of 10 years' experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

1.4 SYSTEM DESIGN

1.4.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm reporting system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to initiating device circuits (IDC) Style D, to signal line circuits (SLC), Style 6, in accordance with NFPA 72. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

- a. Sufficient memory to perform as specified and as shown for addressable system.
- b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors
- c. Capability of each addressable device being individually disabled or enabled from the panel.
- d. Each SLC shall be sized to provide 40 percent addressable expansion without hardware modifications to the panel.

1.4.2 Operational Features

The system shall have the following operating features:

- a. Monitor electrical supervision of IDC, SLC, and NAC. Smoke detectors shall have combined alarm initiating and power circuits.
- b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.
- c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm

zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

- d. A one person test mode. Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
- e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.
- f. Evacuation alarm silencing switch which, when activated, will silence alarm devices, but will not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.
- g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.
- h. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown. An override at the HVAC panel shall not be provided.
- i. The fire alarm control panel shall monitor the fire sprinkler system, or other fire protection extinguishing system.
- j. The control panel and field panels shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to particular input signals; programming certain input signals to activate auxiliary devices.

1.4.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

- a. Transmission of a signal over the station radio fire reporting system. The signal shall be common for any device.
- b. Visual indications of the alarmed devices on the fire alarm control panel display and on the remote audible/visual display.
- c. Continuous sounding or operation of alarm notification appliances throughout the building as required by ANSI S3.41.
- d. Closure of doors held open by electromagnetic devices.

1.4.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.4.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.4.6 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, etc.

1.5 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

- (1) Identification of programmable portions of system equipment and capabilities.
- (2) Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- (3) Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.
- (4) Description of Fire Alarm Control Panel equipment operation.
- (5) Description of auxiliary and remote equipment operations.
- (6) Library of application software.
- (7) Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

Control Panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for LED/LCDs, zones, SLC, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means (single operation) shall be provided for testing the control panel visual indicating devices (meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Visual annunciation shall be provided for LED/LCD visual display as an integral part of the control panel and shall identify with a word description and id number each device. Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate units. Cabinets shall be painted red.

2.1.1 Remote System Audible/Visual Display

Audible appliance shall have a minimum sound level output rating of 85 dBA at 3.05 m and operate in conjunction with the panel integral display. The audible device shall be silenced by a system silence switch on the remote system. The audible device shall be silenced by the system silence switch located at the remote location, but shall not extinguish the visual indication. The remote LED/LCD visual display shall provide identification, consisting of the word description and id number for each device as displayed on the control panel. A rigid plastic, phenolic or metal identification sign which reads "Fire Alarm System Remote Display" shall be provided at the remote audible/visual display. The remote visual appliance located with the audible appliance shall not be extinguished until the trouble or alarm has been cleared.

2.1.2 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each conductor and terminal marked for identification.

2.1.3 System Expansion and Modification Capabilities

Any equipment and software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract.

2.1.4 Addressable Control Module

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled.

2.1.5 Addressable Initiating Device Circuits Module

The initiating device being monitored shall be configured as a Style D initiating device circuit. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.2 STORAGE BATTERIES

Storage batteries shall be provided and shall be 24 Vdc sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 90 hours. Following this period of battery operation, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15 minutes. Batteries shall be located at the bottom of the panel or in a separate battery cabinet. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Cabinets shall be painted to match the fire alarm control panel.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 24 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.4 ADDRESSABLE MANUAL FIRE ALARM STATIONS

Addressable manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into signal line

circuits. Stations shall be installed on flush mounted outlet boxes. Manual stations shall be mounted at 1220 mm above the finished floor. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be matched and painted the same color as the fire alarm manual stations.

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, UL 268A, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors located in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD. Addressable fire detecting devices, except flame detectors, shall be dynamically supervised and uniquely identified in the control panel. All fire alarm initiating devices shall be individually addressable, except where indicated. Installed devices shall conform to NFPA 70 hazard classification of the area where devices are to be installed.

2.5.1 Smoke Detectors

Smoke detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location.

2.5.1.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating in accordance with UL 268. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.5.1.2 Duct Detectors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with NFPA 90A. Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between 2.5 and 20 m/s. Detectors shall be powered from the fire alarm panel. Sampling tubes shall run the full width of the

duct. The duct detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 1.83 m and those mounted below 1.83 m that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall have auxiliary contacts to provide control, interlock, and shutdown functions specified in Section 15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall conform to the applicable requirements of UL 464. Devices shall be connected into notification appliance circuits. Devices shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted red. Recessed audible appliances shall be installed with a grill that is painted red.

2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box recessed grille and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 85 dBA at 3.05 m. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.6.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second. Strobe shall be semi-flush mounted.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.7.1 Electromagnetic Door Hold-Open Devices

Devices shall be attached to the walls unless otherwise indicated. Devices shall comply with the appropriate requirements of UL 228. Devices shall operate on 24 Volt dc power. Compatible magnetic component shall be attached to the door. Under normal conditions, the magnets shall attract

and hold the doors open. When magnets are de-energized, they shall release the doors. Magnets shall have a holding force of 111.2 N (25 pounds). Devices shall be UL or FM approved. Housing for devices shall be brushed aluminum or stainless steel. Operation shall be fail safe with no moving parts. Electromagnetic door hold-open devices shall not be required to be held open during building power failure.

2.7.2 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.7.3 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits shall be No. 16 AWG minimum. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for style 5 addressable systems.

2.7.4 Special Tools and Spare Parts

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer. Two spare fuses of each type and size required shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Spare fuses shall be mounted in the fire alarm panel.

2.8 TRANSMITTERS

2.8.1 Radio Alarm Transmitters

Transmitters shall be compatible with proprietary supervising station receiving equipment. Each radio alarm transmitter shall be the manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitters shall be provided in accordance with applicable portions of NFPA 72, NFPA 1221, and 47 CFR 15. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is Monaco and the transceiver shall be a Monaco BT2-4 transceiver, fully compatible with this equipment. At the contractors option, and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel.

2.8.1.1 Transmitter Power Supply

Each radio alarm transmitter shall be powered by a combination of locally available 120-volt ac power and a sealed, lead-calcium battery.

- a. Operation: Each transmitter shall operate from 120-volt ac power.

In the event of 120-volt ac power loss, the transmitter shall automatically switch to battery operation. Switchover shall be accomplished with no interruption of protective service, and shall automatically transmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply shall also be automatic.

b. Battery Power: Transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 72 hours and be capable of transmitting alarms during that period.

2.8.1.2 Radio Alarm Transmitter Housing

Transmitter housing shall be NEMA Type 1. The housing shall contain a lock that is keyed identical to the fire alarm system for the building. Radio alarm transmitter housing shall be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.8.1.3 Antenna

The Contractor shall provide omnidirectional, coaxial, halfwave dipole antennas for radio alarm transmitters with a driving point impedance to match transmitter output. The antenna and antenna mounts shall be corrosion resistant and designed to withstand wind velocities of 161 km/h. Antennas shall not be mounted to any portion of the building roofing system.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring

to the control panel.

3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 300 mm nor more than 2000 mm above the finished floor. Manually operable controls shall be between 900 and 1100 mm above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 300 mm from any part of any lighting fixture. Detectors shall be located at least 900 mm from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 900 mm, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD in a finished, visible location.

3.1.5 Notification Appliances

Notification appliances shall be mounted 2003 mm above the finished floor or 150 mm below the ceiling, whichever is lower.

3.1.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.1.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in Section 13930 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION and NFPA 72, as indicated on the drawings and as specified herein.

3.1.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall be mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be

supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised.

3.2 OVERVOLTAGE AND SURGE PROTECTION

3.2.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.2.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.2.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.3 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.4 TESTING

The Contractor shall notify the Contracting Officer at least 10 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

3.4.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test

shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

3.4.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form. The test shall include all requirements of NFPA 72 and the following:

- a. Test of each function of the control panel.
- b. Test of each circuit in both trouble and normal modes.
- c. Tests of each alarm initiating devices in both normal and trouble conditions.
- d. Tests of each control circuit and device.
- e. Tests of each alarm notification appliance.
- f. Tests of the battery charger and batteries.
- g. Complete operational tests under emergency power supply.
- h. Visual inspection of wiring connections.
- i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- j. Ground fault
- k. Short circuit faults
- l. Stray voltage
- m. Loop resistance

3.5 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period for systems operation shall consist of 1 training day (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The training period for systems maintenance shall consist of 2 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The training period for system expansions and modifications shall consist of at least 1 training days (8 hours per day) and shall start after the system is

functionally completed but prior to final acceptance tests.

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SECTION 13930A

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	(1997c) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1998) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(1997) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B 88	(1999) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM F 442/F 442M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.4	(1998) Cast Iron Threaded Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded

ASME B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B18.2.1	(1996) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104	1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C203	(1997; addenda C203a - 1999) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(2001) Approval Guide Fire Protection
FM P7825b	(2001) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(1999) Installation of Sprinkler Systems
NFPA 13R	(1999) Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances

NFPA 230 (1999) Fire Protection of Storage

NFPA 1963 (1998) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)

NICET 1014-7 (1995) Program Detail Manual for
Certification in the Field of Fire
Protection Engineering Technology (Field
Code 003) Subfield of Automatic Sprinkler
System Layout

UNDERWRITERS LABORATORIES (UL)

UL 668 (1995; Rev thru Dec 1998) Hose Valves For
Fire Protection Service

UL Bld Mat Dir (2001) Building Materials Directory

UL Fire Prot Dir (2001) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in areas indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density of 4.1 L/min per square meter over the hydraulically most demanding 278.7 square meters of floor area for light hazard; 6.14 L/min per square meter over the hydraulically most demanding 278.7 square meters for ordinary hazard Group 1; and 8.1 L/min per square meter over the hydraulically most demanding 278.7 square meters of floor area for ordinary hazard Group 2. The minimum pipe size for branch lines in gridded systems shall be 32 mm. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 6 m/s.

1.2.1.1 Hose Demand

An allowance for exterior hose streams of 1892.50 L/min shall be added to the sprinkler system demand.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 3.636 bar, and a flow of 7570 Lpm at a residual pressure of 2.736 bar. Water supply shall be presumed available at the point of

connection to existing base watermain. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 150 for existing underground piping. A fire pump shall not be used in the design of the sprinkler system(s).

1.2.1.3 Verification of Water Supply

Prior to the commencement of system design, the Contractor shall verify the water supply available at the site through a hydrant flow test. If the Contractor's hydrant flow test reveals that the water supply (flow and/or pressure) is materially less than the design parameters given in paragraph 1.2.1.2 above, the Contractor shall immediately notify the Contracting Officer in writing of the difference before proceeding with design.

1.2.2 Sprinkler Spacing

To the maximum extent possible, sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed the limits specified in NFPA 13 for the applicable hazard occupancy (light, ordinary, extra).

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinklers shall be installed over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

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SD-02 Shop Drawings

Sprinkler System Shop Drawings; G, A/E.

Three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation. The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13.

Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

As-Built Shop Drawings; G, A/E.

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Protection Related Submittals; G, A/E.

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Components and Equipment Data; G, A/E.

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G, A/E.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts: G, REA/E.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

Preliminary Tests Procedures; G, REA/E.

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests.

Final Acceptance Test Procedures; G, REA/E.

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

On-site Training Schedule; G, REA/E.

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Preliminary Tests; G, A/E.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

Final Acceptance Test; G, A/E.

Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

Fire Protection Specialist Qualifications; G, REA/E.

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer Qualifications; G, REA/E.

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

SD-06 Test Reports

Preliminary Tests Report; G, A/E.

Three copies of the completed Preliminary Tests Reports, no later than 7 days after the completion of the Preliminary Tests.

The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test Report; G, A/E.

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

SD-07 Certificates

Fire Protection Specialist Inspection; G, A/E.

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Wet Pipe Sprinkler System; FIO.

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most

demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 SPRINKLER SYSTEM INSTALLER QUALIFICATIONS

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or

"approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe

Piping from a point 150 mm above the floor to a point 1500 mm outside the building wall, as well as the piping from the underground fire service main to the fire department connection, shall be ductile iron with a rated working pressure of 1034 kPa conforming to AWWA C151, with cement mortar lining conforming to AWWA C104. Piping more than 1500 mm outside the building walls shall comply with Section 02510 WATER DISTRIBUTION SYSTEM.

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111. PVC pipe shall be joined to cast iron/ductile iron fittings and ductile iron pipe by Listed/Approved mechanical joint retainer glands with a minimum pressure rating of 13.8 bar.

2.4.3 Check Valve

Check valve in the fire department connection line shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway, and shall meet the requirements of MSS SP-71, for Type 3 or 4. The check valve shall be installed with an automatic ball-drip valve in a valve pit and connected to the underground fire main on the building side of the post-indicator valve as indicated on the civil drawings. Check valve shall be listed in UL Bld Mat Dir or FMP7825a and FMP7825b.

2.5 ABOVEGROUND PIPING COMPONENTS

Aboveground piping shall be steel.

2.5.1 Steel Piping Components

2.5.1.1 Steel Pipe

Except as modified herein, steel pipe shall be black as permitted by NFPA 13 and shall conform to applicable provisions of ASTM A 795, ASTM A 53/A 53M, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation. Pipe 50 mm and smaller shall be threaded; pipe 65 mm and larger shall be threaded, flanged or grooved. Pipe 50 mm and smaller shall be minimum schedule 40 and pipe 65 mm and larger shall be minimum schedule 10.

2.5.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to ASME B16.4, steel conforming to ASME B16.9 or ASME B16.11, or malleable iron conforming to ASME B16.3. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe

and segmented welded fittings shall not be used.

2.5.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.5.1.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

2.5.2 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and sized to be supported.

2.5.3 Valves

2.5.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

2.5.3.2 Check Valve

Check valve 50 mm and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 100 mm and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.6 WATERFLOW ALARM

Electrically operated, exterior-mounted, waterflow alarm bell shall be provided and installed in accordance with NFPA 13. Waterflow alarm bell shall be rated 24 VDC and shall be connected to the Fire Alarm Control Panel(FACP) in accordance with Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE.

2.7 ALARM INITIATING AND SUPERVISORY DEVICES

2.7.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min or greater. The device shall

contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

2.7.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.8 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting 90 degree y-type with cast brass body, and sign lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 65 mm diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.9 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Orifice of extended coverage sprinklers shall not exceed 13.5 mm. Sprinklers in light hazard occupancies shall be quick response type.

2.9.1 Recessed Sprinkler

Upright sprinkler shall be chrome-plated and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.9.2 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, with nominal 12.7 mm or 13.5 mm orifice. Pendent sprinklers shall have a polished chrome finish.

2.9.3 Upright Sprinkler

Upright sprinkler shall be brass or chrome-plated and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.9.4 Dry Sprinkler Assembly

Dry sprinkler assembly shall be of the pendent type as indicated. Assembly shall include an integral escutcheon. Maximum length shall not exceed maximum indicated in UL Fire Prot Dir. Sprinklers shall have a polished chrome finish.

2.10 ACCESSORIES

2.10.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.10.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.10.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.10.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in areas subject to mechanical damage.

2.10.5 Identification Signs

Valve identification sign shall be minimum 150 mm wide x 50 mm high with enamel baked finish on minimum 1.214 mm steel or 0.6 mm aluminum with red letters on a white background or white letters on red background. Wording of signs shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system is being provided and installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three

working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

3.4.2 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 25 mm pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 25 mm below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 100 mm. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.4.4.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm from ceiling grid.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site.

Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm. When such busings are used, they must be included in hydraulic calculations.

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm pipe connected at the riser as a combination test and drain valve; a test valve located approximately 2 meters above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge. Where flow does not discharge to a paved surface, concrete splash blocks shall be provided.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as indicated and as required by NFPA 13. When the capacity of trapped sections of pipe is less than 11 liters, the auxiliary drain shall consist of a valve not smaller

than 15 mm and a plug or nipple and cap. When the capacity of trapped sections of piping is more than 11 liters, the auxiliary drain shall consist of two 25 mm valves and one 50 x 300 mm condensate nipple or equivalent, located in an accessible location. Tie-in drains shall be provided for multiple adjacent trapped branch pipes and shall be a minimum of 25 mm in diameter. Tie-in drain lines shall be pitched a minimum of 15 mm per 3 m.

3.4.12 Installation of Fire Department Connection

Fire Department Connection (FDC) shall be projecting Y-type with cast brass body, with sign lettered "Auto Spkr". The FDC shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 65 mm diameter American National Fire Hose Connection Screw Threads (NH). The FDC shall be attached to a 100 mm vertical pipe extending above grade 1.2 m. The vertical pipe shall connect to a 100 mm horizontal underground main which connects to the underground fire service main as indicated on the water supply drawings. A 100 mm swing-type check valve shall be installed at the base of the FDC in the horizontal pipe just downstream of the elbow. The check valve shall be equipped with a ball drip valve which drains the FDC and vertical pipe into a gravel-filled drainage sump.

3.4.13 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 900 mm. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 150 mm above the finished floor.

A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 1500 mm outside the building walls shall meet the requirements of Section 02510 WATER DISTRIBUTION SYSTEM.

3.6 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02315 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.7 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Wiring color code shall remain uniform throughout the system.

3.8 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTING, GENERAL.

3.9 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.9.1 Underground Piping

3.9.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

3.9.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 1.89 liters per hour per 100 gaskets or joints, regardless of pipe diameter.

3.9.2 Aboveground Piping

3.9.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.9.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.9.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.10 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

3.11 ON-SITE TRAINING

The Fire Protection Specialist shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time and shall start after the system is functionally complete but prior to the Preliminary Tests and Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

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SECTION 13935A

DRY PIPE SPRINKLER SYSTEM, FIRE PROTECTION
04/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	(1997c) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1998) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(1997) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	(1996) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(2001) Approval Guide Fire Protection
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FM P7825b (2001) Approval Guide Electrical Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-71 (1997) Cast Iron Swing Check Valves,
Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (1999) Installation of Sprinkler Systems

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)

NICET 1014-7 (1995) Program Detail Manual for
Certification in the Field of Fire
Protection Engineering Technology (Field
Code 003) Subfield of Automatic Sprinkler
System Layout

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2001) Building Materials Directory

UL Fire Prot Dir (2001) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Dry pipe sprinkler system shall be provided in areas indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Pipe sizes which are not indicated on the drawings shall be determined by hydraulic calculation. Gridded systems shall not be used. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping, and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density of 8.15 L/min per square meter over the hydraulically most demanding 360 square meters of floor area. Hydraulic calculations shall be provided in accordance with the Area Density Method of NFPA 13. Water velocity in the piping shall not exceed 6 m/s.

1.2.1.1 Hose Demand

An allowance for exterior hose streams of 1892.5 L/min shall be added to the sprinkler system demand.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 3.636 bar, and a flow of 7570 lpm at a residual pressure of

2.736 bar. Water supply shall be presumed available at the point of connection to existing base watermain. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for galvanized steel piping, 140 for new cement-lined ductile-iron piping, and 150 for existing underground piping.

1.2.1.3 Verification of Water Supply

Prior to the commencement of system design, the Contractor shall verify the water supply available at the site through a hydrant flow test. If the Contractor's hydrant flow test reveals that the water supply (flow and/or pressure) is materially less than the design parameters given in paragraph 1.2.1.2 above, the contractor shall immediately notify the Contracting Officer in writing of the difference before proceeding with design.

1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed the limits specified in NFPA 13 for the applicable hazard occupancy.

1.2.3 System Volume Limitations

Where the volume of any individual system piping volume exceeds 1890 liters the dry pipe valve shall be provided with a quick-opening device. The maximum system capacity controlled by one dry pipe valve shall not exceed 2800 liters. The calculated volume of each system shall be indicated on the Sprinkler System Shop Drawings.

1.3 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

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SD-02 Shop Drawings

Shop Drawings; G, A/E

Three copies of the Sprinkler System Drawings, no later than 21 days prior to the start of sprinkler system installation. The Sprinkler System Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
- b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.
- c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
- d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.
- e. Details of each type of riser assembly; air supply system and piping; pipe hanger and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

As-Built Drawings; G, A/E.

As-built shop drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Protection Related Submittals; G, A/E

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Materials and Equipment; G, A/E

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate

compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G, A/E

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Spare Parts; G, REA/E.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

Preliminary Tests; G, A/E

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

Final Acceptance Test; G, A/E

Proposed procedures for Final Acceptance Test, no later than 14 days prior to the proposed start of the tests.

Proposed date and time to begin Final Acceptance Test, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

Fire Protection Specialist; G, REA/E

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system shop drawings and hydraulic calculations.

Sprinkler System Installer Qualifications; G, REA/E

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

Onsite Training; G, A/E

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

SD-06 Test Reports

Preliminary Tests; G, A/E

Three copies of the completed Preliminary Tests Reports, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Test; G, A/E

Three copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

SD-07 Certificates

Inspection by Fire Protection Specialist; G, A/E

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G, A/E.

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

1.7 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow,

velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.8 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.9 SPRINKLER SYSTEM INSTALLER QUALIFICATIONS

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or

"approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4 ABOVEGROUND PIPING COMPONENTS

2.4.1 Steel Pipe

Except as modified herein, steel pipe shall be galvanized conforming to the applicable requirements of NFPA 13, and ASTM A 795, ASTM A 53/A 53M, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe 50 mm and smaller shall be minimum schedule 40 and pipe 65 mm and larger shall be minimum schedule 10. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.4.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be galvanized steel conforming to ASME B16.9 or ASME B16.11.

Fittings that sprinklers, drop nipples or riser nipples (sprigs) are screwed into shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used. Pipe 50 mm and smaller shall be threaded and pipe 65 mm and larger shall be threaded, flanged or grooved.

2.4.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gaskets shall be of silicon compound and approved for dry fire protection systems. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.4.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

2.4.5 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and size to be supported.

2.4.6 Valves

2.4.6.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

2.4.6.2 Check Valve

Check valve 50 mm and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 100 mm and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.5 DRY PIPE VALVE ASSEMBLY

The dry pipe valve shall be a latching differential type listed in UL Fire Prot Dir or FM P7825a and FM P7825b and shall be complete with trim piping, valves, fittings, pressure gauges, priming water fill cup, velocity drip check, drip cup, and other ancillary components as required for proper operation. The assembly shall include a quick-opening device by the same manufacturer as the dry pipe valve for systems over 1890 liters in capacity.

2.6 SUPERVISORY AIR SYSTEM

Air supply system shall be in accordance with NFPA 13. The connection pipe from the air compressor shall not be less than 15 mm in diameter and shall enter the system above the priming water level of the dry pipe valve. A check valve shall be installed in the system supply air piping from the compressor. A shutoff valve of the renewable disc type shall be installed upstream of this check valve. The air supply system shall be sized to pressurize the sprinkler system to 275 kPa within 20 minutes.

2.6.1 Air Compressor

Compressor shall be a riser-mounted single stage oil-free type, air-cooled, electric-motor driven, equipped with a check valve, shutoff valve and pressure switch for automatic starting and stopping. Pressure switch shall be factory set to start the compressor at 200 kPa and stop it at 300 kPa. A safety relief valve, set to operate at 450 kPa, shall be provided.

2.6.2 Air Pressure Maintenance Device

Device shall be a pressure regulator that automatically reduces supply air to provide the pressure required to be maintained in the piping system. The device shall have a cast bronze body and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1.6 mm restriction to prevent rapid pressurization of the system, and adjustment screw. The device shall be capable of reducing an inlet pressure of up to 680 kPa to a fixed outlet pressure adjustable to 70 kPa.

2.6.3 Air Supply Piping System

System shall be configured so that each dry pipe system is equipped with a separate pressure maintenance device, air compressor, shutoff valve, bypass valve and pressure gauge. Piping shall be galvanized steel in accordance with ASTM A 795 or ASTM A 53/A 53M.

2.6.4 Low Air Pressure Alarm Device

Each dry pipe valve trim shall be provided with a local alarm device consisting of a metal enclosure containing an alarm horn or bell, silence switch, green power-on light, red low-air alarm light and amber trouble light. The alarm device shall be activated by the low air pressure switch.

Upon reduction of sprinkler system pressure to approximately 70 kPa above the dry valve trip point pressure, the low air pressure switch shall actuate the audible alarm device and a red low-air alarm light. Restoration of system pressure shall cause the low-air alarm light to be extinguished and the audible alarm to be silenced. An alarm silence switch shall be provided to silence the audible alarm. An amber trouble light shall be provided which will illuminate upon operation of the silence switch and shall be extinguished upon return to its normal position.

2.7 ALARM INITIATING AND SUPERVISORY DEVICES

2.7.1 Sprinkler Pressure (Waterflow) Alarm Switch

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 15 mm NPT male pipe thread. The switch shall have a maximum service pressure rating of 1207 kPa. There shall be two SPDT (Form C) contacts factory adjusted to operate at 28 to 55 kPa. The switch shall be capable of being mounted in any position in the alarm line trim piping of the dry pipe valve.

2.7.2 Low Air Pressure Supervisory Switch

The pressure switch shall supervise the air pressure in system and shall be set to activate at 70 kPa above the dry pipe valve trip point pressure. The switch shall have an adjustable range between 35 kPa and 500 kPa. The switch shall have screw terminal connection and shall be capable of being wired for normally open or normally closed circuit.

2.7.3 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.8 SPRINKLERS

Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed spacing limitations. Areas where sprinklers are connected to or are a part of the dry pipe system shall be considered unheated and subject to freezing. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Orifice of extended coverage sprinklers shall not exceed 13.5 mm.

2.8.1 Pendent Sprinkler

Pendent sprinkler heads shall be the dry pendent type, unless otherwise indicated. Pendent sprinkler shall be of the fusible strut or glass bulb type, with nominal 13.5 mm orifice. Pendent sprinklers shall have a brass finish. Assembly shall include an integral escutcheon. Maximum length shall not exceed the maximum length indicated in UL Fire Prot Dir.

2.8.2 Upright Sprinkler

Upright sprinkler shall be brass and shall have a nominal 13.5 mm orifice.

2.9 ACCESSORIES

2.9.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.9.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.9.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.9.4 Identification Sign

Valve identification sign shall be minimum 150 mm wide by 50 mm high with enamel baked finish on minimum 1.214 mm steel or 0.6 mm aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of NFPA 13 and publications referenced therein.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

3.4.2 Piping in Exposed Areas

Exposed piping shall be installed so as not diminish exit access widths, corridors, or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers Locations

Sprinklers installed in the pendent position shall be of the listed dry pendent type, unless otherwise indicated. Dry pendent sprinklers shall be of the required length to permit the sprinkler to be threaded directly into a branch line tee. Hangers shall be provided on arm-overs exceeding 300 mm in length. Dry pendent sprinkler assemblies shall be such that sprinkler ceiling plates or escutcheons are of the uniform depth throughout the finished space. Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm from ceiling grid. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site.

Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not

manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm. When such bushings are used, they shall be included in hydraulic calculations.

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm pipe connected to the remote branch line; a test valve located approximately 2 meters above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge. Where flow does not discharge to a paved surface, concrete splash blocks shall be provided.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building or to a sanitary drain. Auxiliary drains shall be provided as indicated and as required by NFPA 13. When the capacity of trapped sections of pipe is less than 11 liters, the auxiliary drain shall consist of a valve not smaller than 15 mm and a plug or nipple and cap. When the capacity of trapped sections of piping is more than 11 liters, the auxiliary drain shall consist of two 25 mm valves and one 50 x 300 mm condensate nipple or equivalent, located in an accessible location. Tie-in drains shall be provided for multiple adjacent trapped branch pipes and shall be a minimum of 25 mm in diameter. Tie-in drain lines shall be pitched a minimum of 15 mm per 3 mm.

3.4.12 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main

drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 ELECTRICAL WORK

Except as modified herein, electric equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section 13851 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Wiring color code shall remain uniform throughout the system.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTING, GENERAL.

3.7 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.7.1 Aboveground Piping

3.7.1.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.7.1.2 Air Pressure Test

As specified in NFPA 13, an air pressure leakage test at 350 kPa shall be conducted for 24 hours. There shall be no drop in gauge pressure in excess of 10 kPa for the 24 hours. This air pressure test is in addition to the required hydrostatic test.

3.7.2 Testing of Alarm Devices

Each alarm initiating device, including pressure alarm switch, low air pressure switch, valve supervisory switch, and electrically-operated switch shall be tested for proper operation.

3.7.3 Trip Tests of Dry Pipe Valves

Each dry pipe valve shall be trip-tested by reducing normal system air pressure through operation the inspector's test connection. Systems equipped with quick opening devices shall be first tested without the operation of the quick opening device and then with it in operation. Test results will be witnessed and recorded. Test results shall include the

number of seconds elapsed between the time the test valve is opened and tripping of the dry valve; trip-point air pressure of the dry pipe valve; water pressure prior to valve tripping; and number of seconds elapsed between time the inspector's test valve is opened and water reaches the orifice.

3.7.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.8 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. Each system shall be completely drained after each trip test. The system air supply system shall be tested to verify that system pressure is restored in the specified time. In addition, the Fire Protection Specialist shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. After the system has been tested and drained, the system shall be drained periodically for at least 2 weeks until it can be assured that water from the system has been removed.

3.9 ONSITE TRAINING

The Fire Protection Specialist and Manufacturer's Representative shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 4 hours of normal working time and shall start after the system is functionally complete but prior to the Preliminary Tests and Final Acceptance Test. The Onsite Training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

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SECTION 13945A

PREACTION AND DELUGE SPRINKLER SYSTEMS, FIRE PROTECTION
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	(1997c) Electric-Resistance-Welded Steel Pipe
ASTM A 183	(1983; R 1998) Carbon Steel Track Bolts and Nuts
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 795	(1997) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	(1996) Square and Hex Bolts and Screws Inch Series
ASME B18.2.2	(1987; R 1993) Square and Hex Nuts (Inch Series)

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825a	(2001) Approval Guide Fire Protection
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FM P7825b (2001) Approval Guide Electrical Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-71 (1997) Cast Iron Swing Check Valves,
Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (1999) Installation of Sprinkler Systems

NFPA 24 (1995) Installation of Private Fire
Service Mains and Their Appurtenances

NFPA 70 (1999) National Electrical Code

NFPA 72 (1999) National Fire Alarm Code

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)

NICET 1014-7 (1995) Program Detail Manual for
Certification in the Field of Fire
Protection Engineering Technology (Field
Code 003) Subfield of Automatic Sprinkler
System Layout

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2001) Building Materials Directory

UL Fire Prot Dir (2001) Fire Protection Equipment Directory

UL 268 (1996; Rev thru Jun 1998) Smoke Detection
for Fire Protective Signaling Systems

1.2 GENERAL REQUIREMENTS

Preaction sprinkler system(s) shall be provided in areas indicated on the drawings. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall meet the requirements of NFPA 13 and NFPA 72. The sprinkler systems shall be a double-interlocked system that requires the actuation of an alarm initiating device and loss of air pressure to open the water control (deluge) valve. The Contractor shall design any portions of the sprinkler system that are not indicated on the drawings including locating sprinklers, piping, and equipment, and size piping and equipment when this information is not indicated on the drawings or is not specified herein. Pipe sizes which are not indicated on the drawings shall be determined by hydraulic calculations.

1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density of 4.1 L/min per square meter over the hydraulically most demanding 278.7 square meters of floor area for light hazard; 6.14 L/min per square meter over the hydraulically most demanding 278.7 square meters for ordinary hazard group 1; and 8.1 L/min per square meter over the hydraulically most demanding 278.7 square meters of floor area for ordinary hazard group 2. The minimum pipe size for branch lines in gridded systems shall be 32 mm. Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13. Water velocity in the piping shall not exceed 6 m/s.

1.2.1.1 Hose Demand

An allowance for exterior hose streams of 1892.5 L/min gpm shall be added to the sprinkler system demand.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 3.636 bar, and a flow of 7570 lpm at a residual pressure of 2.736 bar. Water supply shall be presume available at the point of connecting to existing base watermain. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, 150 for existing underground piping.

1.2.1.3 Verification of Water Supply

Prior to the commencement of system shop drawings, the contractor shall verify the water supply available at the site through a hydrant flow test. If the contractor's hydrant flow test reveals that the water supply (flow and/or pressure) is materially less than the design parameters given in paragraph 1.2.1.2 above, the contractor shall immediately notify the contracting officer in writing of the difference before proceeding with design.

1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in NFPA 13 for light and ordinary hazard occupancy.

1.2.3 Control System

The control system shall meet the requirements of NFPA 72. The control panel shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b for "Releasing Device Service". The control panel and the solenoid valve that activates the water control valves shall be compatible with each other. Compatibility shall be per specific UL listing or FM approval of the control equipment.

1.2.3.1 Power Supply

The primary operating power shall be provided from two single-phase 120 VAC circuits. Transfer from normal to backup power and restoration from backup to normal power shall be fully automatic and shall not initiate a false alarm. Loss of primary power shall not prevent actuation of the respective automatic water control valve upon activation of any alarm initiating device. Backup power shall be provided through use of rechargeable,

sealed, lead calcium storage batteries.

1.2.3.2 Circuit Requirements

Alarm initiating devices shall be connected to initiating device circuits (IDC), Style D or to signal line circuits (SLC), Style 6, in accordance with NFPA 72. Alarm notification or indicating appliances shall be connected to notification appliance circuit (NAC), Style X in accordance with NFPA 72. A separate circuit shall be provided for actuation of each individual automatic water control valve. The circuits that actuate the water control valves shall be fully supervised so that the occurrence of a single open or a single ground fault condition in the interconnecting conductors shall be indicated at the control panel.

1.3 SYSTEM OPERATIONAL FEATURES

The system shall include a smoke detection system, manual actuation stations, supervisory and alarm switches, control panel and associated equipment. Preaction sprinkler system piping shall be provided with supervisory air pressure not to exceed 210 kPa.

1.3.1 System Actuation

The system shall be a double-interlocked preaction system requiring electric and pneumatic actions to release. System activation shall be as a result of operation of both a detection device and loss of air pressure in the piping. Operation of a single detection device shall energize the preaction valve solenoid. Loss of air pressure shall result in operation of a pneumatic actuator. System operation shall also be by manual release located on the preaction valve assembly.

1.3.2 Alarm Functions

Activation of any sprinkler waterflow pressure switch, smoke detector or manual release station shall annunciate an alarm condition at the releasing control panel. Loss of air pressure or activation of a valve tamper switch shall annunciate a supervisory condition at the releasing control panel. Circuit trouble conditions shall be annunciated at the releasing control panel as supervisory and trouble conditions, respectively.

1.4 COORDINATION OF TRADES

Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.6 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting

Officer of any discrepancy before performing the work.

1.7 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

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SD-02 Shop Drawings

Shop Drawings; G, A/E

Three (3) copies of the Sprinkler System Drawings, no later than 21 days prior to the start of sprinkler system installation. The Sprinkler System Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

f. Complete point-to-point wiring diagram of the detection and control system. Indicate the detailed interconnection of control panel modules to the devices, the number and size of conductors in each conduit, and size of conduit. Connection points shall be indicated and coordinated with the terminal identification marked on the devices. Complete internal wiring schematic of the control panel and each electrical device shall be provided.

As-Built Drawings; G, A/E.

As-built drawings, at least 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

SD-03 Product Data

Fire Protection Specialist; G, REA/E

The name and documentation of certification of the proposed Fire Protection Specialists, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system shop drawings and hydraulic calculations.

Sprinkler System Installer Qualifications; G, REA/E

The name and documentation of certification of the proposed Sprinkler System Installer, concurrent with submittal of the Fire Protection Specialist Qualifications.

Fire Protection Related Submittals; G, A/E.

A list of the Fire Protection Related Submittals, no later than 7 days after the approval of the Fire Protection Specialist.

Materials and Equipment; G, A/E

Manufacturer's catalog data included with the Sprinkler System Drawings for all items specified herein. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with all contract requirements. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations; G, A/E

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

Storage Batteries; G, A/E

Calculations to substantiate the total requirements for supervisory and alarm power. Ampere-hour requirements for each system component and each control panel component or module, under both normal and alarm conditions shall be included. The battery recharging period shall be included with the calculations.

Spare Parts; G, REA/E.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

Preliminary Tests; G, A/E

Proposed procedures for Preliminary Tests, no later than 14 days prior to the proposed start of the tests.

Proposed date and time to begin Preliminary Tests, submitted with the Preliminary Tests Procedures.

Final Acceptance Tests; G, A/E

Proposed procedures for Final Acceptance Tests, no later than 14 days prior to the proposed start of the tests.

Proposed date and time to begin Final Acceptance Tests, submitted with the Final Acceptance Test Procedures. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

On-site Training Schedule; G, ~~REA/E~~

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

SD-06 Test Reports

Preliminary Tests; G, A/E

Three (3) copies of the completed Preliminary Tests Reports, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Preliminary Tests Report shall be signed by the Fire Protection Specialist.

Final Acceptance Tests; G, A/E

Three (3) copies of the completed Final Acceptance Tests Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Specialist.

SD-07 Certificates

Inspection by Fire Protection Specialist; G, ~~REA/E~~

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Specialist that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary, Detection and Control Systems, and Final Acceptance Test Reports.

SD-10 Operation and Maintenance Data

Preaction Sprinkler System; G, A/E.

Six (6) manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at

least 14 days prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.

1.8 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data shown on the drawings. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.9 FIRE PROTECTION SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.10 SPRINKLER SYSTEM INSTALLER QUALIFICATIONS

Work specified in this section shall be performed by the Sprinkler System Installer. The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.11 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of NFPA 13 and NFPA 24 shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

Materials and equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM P7825a and FM P7825b. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM P7825a and FM P7825b.

2.4 ABOVEGROUND PIPING COMPONENTS

2.4.1 Steel Pipe

Except as modified herein, steel pipe shall be galvanized conforming to the applicable requirements of NFPA 13, and ASTM A 795, ASTM A 53/A 53M, or ASTM A 135. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation. Pipe 50 mm and smaller shall be minimum Schedule 40 and pipe 65 mm and larger shall be minimum Schedule 10.

2.4.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be galvanized steel conforming to ASME B16.9 or ASME B16.11. Fittings that sprinklers, drop nipples or riser nipples (sprigs) are screwed into shall be threaded type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

2.4.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service

and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A 47/A 47M, Grade 32510; ductile iron conforming to ASTM A 536, Grade 65-45-12. Gaskets shall be of silicon compound and approved for dry fire protection systems. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A 183 and shall be cadmium plated or zinc electroplated.

2.4.4 Flanges

Flanges shall conform to NFPA 13 and ASME B16.1. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to ASME B18.2.1 and nuts shall be hexagon type conforming to ASME B18.2.2.

2.4.5 Pipe Hangers

Hangers shall be listed in UL Fire Prot Dir or FM P7825a and FM P7825b and of the type suitable for the application, construction, and pipe type and size to be supported.

2.4.6 Valves

2.4.6.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b.

2.4.6.2 Check Valves

Check valves 50 mm and larger shall be listed in UL Bld Mat Dir or FM P7825a and FM P7825b. Check valves 100 mm and larger shall be of the swing type with flanged cast iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

2.5 AUTOMATIC WATER CONTROL VALVE (DELUGE VALVE)

Automatic water control valve (deluge valve) shall be electrically-actuated and rated for a working pressure of 1207 kPa. Valve shall be capable of being reset without opening the valve. Electrical solenoid valve used to actuate the water control valve shall be an integral component of the valve or shall be approved for use by the water control valve manufacturer. Solenoid valve shall be rated at 24 volts direct current, and shall be normally closed type that operates when energized. Solenoid valves shall be rated for a maximum pressure differential of 1207 kPa. Water control valve shall be equipped with a means to prevent the valve from returning to the closed position until being manually reset. Assembly shall be complete with the valve manufacturer's standard trim piping, drain and test valves, pressure gauges, and other required appurtenances. Each assembly shall include an emergency release device for manually tripping the water control valve in the event of a power or other system failure. Device shall be a standard accessory component of the valve manufacturer and shall be labeled as to its function and method of operation.

2.6 SUPERVISORY AIR SYSTEM

2.6.1 Air Compressor

Air compressor shall be a riser-mounted single stage oil-less type, air cooled, electric-motor driven, equipped with a check valve, centrifugal pressure and moisture unloader, pressure switch for automatic starting and stopping. A safety relief valve shall be provided. The compressor shall be sized to pressurize the system within 30 minutes.

2.6.2 Air Pressure Maintenance Device

Device shall be a pressure regulator that automatically reduces supply air pressure to the minimum pressure required to be maintained in the piping system. The device shall have a cast bronze body and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1.6 mm restriction to prevent rapid pressurization of the system, and adjustment screw. The device shall be capable of reducing maximum inlet pressure of 680 kPa to a fixed outlet pressure adjustable to 70 kPa.

2.6.3 Air Supply Piping System

Each preaction system shall be equipped with a separate pressure maintenance device, shutoff valve, bypass valve and pressure gauge. Piping shall be galvanized steel in accordance with ASTM A 795 or ASTM A 53/A 53M.

2.6.4 Low Air Pressure Switch

Each preaction system shall be provided with an air pressure switch connected to the releasing control panel. Upon reduction of supervisory air pressure to approximately 70 kPa, the low air pressure switch shall actuate the audible alarm device and an amber (supervisory) low-air alarm light on the RCP annunciator.

2.7 SPRINKLERS

Sprinklers for preaction systems shall be automatic, fusible solder or glass bulb type. Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Orifice of extended coverage sprinklers shall not exceed 13.5 mm.

2.7.1 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, quick-response type with nominal 12.7 mm orifice. Pendent sprinklers shall have a polished chrome finish.

2.7.2 Upright Sprinkler

Upright sprinkler shall be brass quick-response type and shall have a nominal 12.7 mm or 13.5 mm orifice.

2.8 ACCESSORIES

2.8.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be

representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided. Locate spare sprinkler cabinet adjacent to main building sprinkler riser.

2.8.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.8.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

2.8.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in areas subject to mechanical damage.

2.8.5 Identification Sign

Valve identification sign shall be minimum 150 mm wide by 50 mm high with enamel baked finish on minimum 1.214 mm steel or 0.6 mm aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.9 CONTROL PANEL

Panel shall be UL listed or FM approved for "Releasing Device Service" or shall have modules approved for this purpose. Panel shall contain all components and equipment required to provide the specified operational and supervisory functions of the system. Components shall be housed in a surface-mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly factory assembled and wired unit. Panel shall include integral "power on," "alarm," and "trouble" lamps with annunciation of each alarm, supervisory and trouble signal. The panel shall have prominent rigid plastic or metal identification plates for lamps, zones, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the working condition and accuracy of the control panel visual indicating devices (meter and lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

2.9.1 Zone Annunciator

A separate alarm and trouble lamp shall be provided for each active and spare zone and shall be located on exterior of cabinet door or be visible

through the cabinet door. A minimum of one (1) spare alarm zone that is fully operational shall be provided. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic or metal sign with either raised or engraved letters. Zone identification shall consist of a unique zone number as well as a word description of the zone.

2.9.2 System Zoning

The system shall be zoned as follows:

- Zone 1: Smoke detector
- Zone 2: Waterflow
- Zone 3: Manual Release
- Zone 4: Low air

2.9.3 Primary Power Supply

Primary power and trouble alarm power to the Control Panel shall be supplied from two 120 VAC circuits. Panel shall be equipped with two (2) 20-amp circuit breakers for each control panel and with key lock. Disconnect switch shall be permanently marked "PREACTION SPRINKLER SYSTEM".

2.9.4 Emergency Power Supply

Emergency power shall be provided for system operation in the event of failure of the primary power supply and shall consist of rechargeable storage battery system. Transfer from normal to emergency power or restoration from emergency to normal power shall be automatic and shall not cause transmission of a false alarm.

2.9.4.1 Storage Batteries

Storage Batteries shall be sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the system for a period of 90 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all alarm indicating devices in the alarm mode for a minimum period of 15 minutes. Battery cabinet shall be a separate compartment at the bottom of the control panel. The battery cabinet shall have adequate space for spare duplicate storage batteries. Batteries shall be mounted on a noncorrosive and nonconductive base or pad.

2.9.4.2 Battery Charger

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours using the high charging rate. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly. The charger shall be located in control panel cabinet.

2.10 ALARM INITIATING DEVICES

2.10.1 Smoke Detectors

Smoke detectors shall be designed for detection of abnormal smoke

densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making wiring connections. Detectors that are to be installed in concealed (above false ceilings, etc.) locations shall be provided with a remote indicator LED/LCD suitable for mounting in a finished, visible location.

2.10.1.1 Photoelectric Detector

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rate in accordance with UL 268.

2.10.2 Manual Actuation Station

Station shall be mounted at 1220 mm above the floor, unless otherwise shown. Station shall be arranged to activate the deluge system. Station shall be dual-action type requiring two separate operations in order to cause system discharge. Station shall be colored red. Station shall be provided with a positive visible indication of operation of the station. Station shall be weatherproof type and shall be provided with an engraved label indicating PREACTION SYSTEM.

2.10.3 Sprinkler Pressure Alarm Switch (Waterflow Alarm)

Pressure switch shall include a metal housing with a neoprene diaphragm, SPDT snap action switches. The switch shall have a service pressure rating of 1200 kPa. There shall be two SPDT (Form C) contacts factory adjusted to operate at 30 to 60 kPa. The switch shall be capable of being mounted in any position in the alarm line trim piping of the alarm check valve.

2.10.4 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.11 WIRING

Wiring for alternating current (AC) circuits shall be 12 AWG minimum. Wiring for low voltage direct current (DC) circuits shall be No. 16 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in electrical metallic tubing or in metallic conduit, except rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same function shall be similarly color coded. Wiring color code shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, alarm indicating, supervisory, and actuation circuits are prohibited.

PART 3 EXECUTION

3.1 FIRE PROTECTION RELATED SUBMITTALS

The Fire Protection Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful installation of the sprinkler systems(s). The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

3.2 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of publications referenced herein.

3.3 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist shall inspect the sprinkler system periodically during the installation to assure that the sprinkler system installed in accordance with the contract requirements. The Fire Protection Specialist shall witness the preliminary and final tests, and shall sign the test results. The Fire Protection Specialist, after completion of the system inspections and a successful final test, shall certify in writing that the system has been installed in accordance with the contract requirements. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.4 ABOVEGROUND PIPING INSTALLATION

3.4.1 Protection of Piping Against Earthquake Damage

The system piping shall be protected against damage from earthquakes. Seismic protection shall include flexible and rigid couplings, sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

3.4.2 Piping in Exposed Areas

Exposed piping shall be installed so as not diminish exit access widths, corridors, or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.4.4 Pendent Sprinklers Locations

Sprinklers installed in the pendent position shall be of the listed dry pendent type, unless otherwise indicated. Dry pendent sprinklers shall be of the required length to permit the sprinkler to be threaded directly into a branch line tee. Hangers shall be provided on arm-overs exceeding 300 mm in length. Dry pendent sprinkler assemblies shall be such that sprinkler ceiling plates or escutcheons are of the uniform depth throughout the finished space. Pendent sprinklers in suspended ceilings shall be a minimum of 150 mm from ceiling grid. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range

and shall be of uniform depth throughout the finished area.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm in length shall be individually supported.

3.4.6 Pipe Joints

Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

3.4.7 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm .

3.4.8 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07840 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.4.9 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm pipe connected to the remote branch line; a test valve with integral orifice and site glass, located approximately 2 meters above the floor on the wall near

the deluge valve and a painted metal identification sign affixed to the valve with the words "Inspector's Test". The test connection shall pipe directly to drain.

3.4.11 Drains

Main drain piping shall be provided to discharge at a safe point outside the building or sanitary floor drain at riser. Auxiliary drains shall be provided as indicated and as required by NFPA 13. When the capacity of trapped sections of pipe is less than 11 liters, the auxiliary drain shall consist of a valve not smaller than 15 mm and a plug or nipple and cap. When the capacity of trapped sections of piping is more than 11 liters, the auxiliary drain shall consist of two 25 mm valves and one 50 x 300 mm condensate nipple or equivalent, located in an accessible location. Tie-in drains shall be provided for multiple adjacent trapped branch pipes and shall be a minimum of 25 mm in diameter. Tie-in drain lines shall be pitched a minimum of 15 mm per 3 m.

3.4.12 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.5 ELECTRICAL WORK

Unless otherwise specified herein, power supply equipment and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

3.5.1 Overcurrent and Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. Cables and conductors that serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.5.2 Grounding

Grounding shall be provided to building ground.

3.5.3 Wiring

System field wiring shall be installed in 20 mm minimum diameter electrical metallic tubing or metallic conduit. Wiring for the sprinkler system fire detection and control system shall be installed in tubing or conduits dedicated for that use only and not installed in conduit, outlet boxes or junction boxes which contain lighting and power wiring or equipment. Circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked and labeled in accordance with the wiring diagram. No more than one conductor shall be installed under any screw terminal. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors is not permitted. Wiring within any control equipment shall be readily accessible without removing any component parts. Conductors shall be color-coded and shall be identified within each enclosure where a connection or termination is made. Conductor identification shall be by plastic-coated, self-sticking, printed markers

or by heat-shrink type sleeves. Circuits shall be wired to maintain electrical supervision so that removal of any single wire from any device shall cause a "trouble" condition on the control panel.

3.5.4 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 600 mm and not more than 2000 mm above the finished floor.

3.5.5 Detectors

Detectors shall be ceiling-mounted per NFPA 72 and shall be at least 300 mm from any part of any lighting fixture. Detectors shall be located at least 900 mm from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location.

3.5.6 Manual Actuation Stations

Manual actuation stations shall be mounted readily accessible and 1220 mm above the finished floor.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping shall be as specified in Section 09900 PAINTING, GENERAL.

3.7 PRELIMINARY TESTS

The system including the underground water mains, the aboveground piping, detectors and control system and system components shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

3.7.1 Aboveground Piping

3.7.1.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

3.7.1.2 Air Pressure Test

As specified in NFPA 13, an air pressure leakage test at 350 kPa shall be conducted for 24 hours. There shall be no drop in gauge pressure in excess of 10 kPa for the 24 hours. This air pressure test is in addition to the required hydrostatic test.

3.7.2 Detection and Control System Tests

Upon completion of the installation, the detection and control system shall be subjected to functional and operational performance tests including tests of each installed initiating device, system actuation device and notification appliance. The control system tests specified in paragraph FINAL ACCEPTANCE TESTS shall be conducted to ensure that the system is completely functional and that wiring has been properly connected. If deficiencies are found, corrections shall be made and the system shall be retested to assure that the systems have no deficiencies.

3.7.3 Automatic Water Control Valve Test

Each water control valve shall be independently trip-tested in accordance with the manufacturer's published instructions. Each valve shall be electrically trip-tested by actuating a respective smoke detector and a manual actuation station connected to the control panel and a manual actuation device that is part of the valve trim. A full-flow main drain test shall be made. For preaction systems with supervisory air, the air pressure shall be reduced to verify proper operation of the air supply system and associated supervisory alarm devices.

3.8 FINAL ACCEPTANCE TESTS

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. The Fire Protection Specialist shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. Each system shall be completely drained after each trip test. The system air supply system shall be tested to verify that system pressure is restored in the specified time. In addition, the Fire Protection Specialist shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. After the system has been tested and drained, the system shall be drained periodically for at least 2 weeks until it can be assured that water from the system has been removed.

3.8.1 Control System Test

Testing shall be in accordance with NFPA 72. The test shall include the following:

- a. Visual inspection of wiring connections.
- b. Opening the circuit at each alarm initiating device, solenoid valve, and notification appliance to test the wiring and supervisory features.
- c. Test of each function of the control panel.
- d. Test of each circuit in the normal, open and ground fault modes.
- e. Test of each initiating device in both normal and trouble conditions.
- f. Test of each control circuit and device.

- g. Test of the battery charger and batteries.
- h. Operational tests under emergency power supply, including activation of connected alarm notification appliances for the specified time period.

3.8.2 Trip-tests of Automatic Water Control Valves

Each water control valve shall be independently trip-tested in accordance with the manufacturer's published instructions. Each valve shall be electrically trip-tested by actuating a respective smoke detector, a manual actuation station connected to the system control panel and the manual release which is part of the valve trim. Each valve shall be returned to normal condition after each test. Prior to trip testing sprinkler deluge system, precautionary steps shall be taken to prevent water damage to the building and equipment from sprinkler discharge. Control valves on preaction systems shall remain open until piping is filled with water.

3.8.3 Tests of Supervisory Air System

Preaction system supervisory air pressure shall be reduced from the normal system pressure to the point at which a low-pressure alarm is sounded. Air pressure shall be restored to verify trouble signal restoration. Automatic start/stop features of air compressor shall be tested.

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DIVISION 14 - CONVEYING SYSTEMS

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SECTION 14450

VEHICLE LIFTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AUTOMOTIVE LIFT INSTITUTE (ALI)

ALI Automotive Lift Institute

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 176	(1999) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 366/A 366M	(1997e1) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 568/A 568M	(1998e1) Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled
ASTM A 569/A 569M	(1998) Commercial Steel (CS) Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled
ASTM A 666	(1999) Annealed or Cold-worked austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials

ASME INTERNATIONAL (ASME)

ASME A17.1	(1998a) Safety Code for Elevators and Escalators
ASME A17.2.1	(1997a) Inspectors' Manual for Electric Elevators
ASME QE1-1	(1997) Standard for the Qualification of Elevator Inspectors

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities
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U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04 (1998) Seismic Design for Buildings

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD 795 (Basic) Uniform Federal Accessibility Standards

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.11 (1999) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

IEEE C62.45 (1992) IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits

IEEE Std 304 (1977; R 1991) Test Procedure for Evaluation and Classification of Insulation Systems for Direct-Current Machines

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500 Manual (1988) Metal Finishes Manual for Architectural and Metal Products

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO Bldg Code (1997) Uniform Building Code (3 Vol.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1995) High-Pressure Decorative Laminates

NEMA MG 1 (1998) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 252 (1999) Fire Tests of Door Assemblies

UNDERWRITERS LABORATORIES (UL)

UL 1449 (1996; Rev thru Dec 1999) Transient Voltage Surge Suppressors

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

*8

SD-02 Shop Drawings

Vehicle Lift; G A/E

Detail drawings including dimensioned layouts in plan and elevation showing the arrangement of vehicle lift and equipment, anchorage of equipment, clearances for maintenance and operation; details on controllers, motors, and points of interface with power, HVAC, or exhaust systems. Drawings shall contain complete wiring diagrams showing electrical connections and other details required to demonstrate operation and functions of system devices.

Drawings shall include the appropriate sizing of electrical protective devices which are frequently different from National Electrical Code standard sizes.

SD-03 Product Data

Training Data

Information describing the training course for operating personnel, training aids and samples of training aids and samples of training materials to be used, training schedules, and notification of training.

Vehicle Lift System

A complete list of equipment and material, including illustrations, schedules, manufacturer's descriptive data and technical literature, performance charts, catalog cuts, installation instructions, brochures, diagrams, and other information required for fabrication and installation of the equipment. Spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than two weeks prior to date of beneficial occupancy. Data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended to be replaced and replacement interval required. Data shall include the appropriate sizing of electrical protective devices.

Framed Instructions

Diagrams, instructions, and other sheets, proposed for posting.

Test Procedures

A plan detailing the testing procedures shall be submitted 30 days prior to performing the vehicle lift tests.

SD-04 Samples

Finishes

Samples of materials and products requiring color or finish selection.

SD-06 Test Reports

Testing

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of installed system.

SD-07 Certificates

Qualification Certificates; G ~~REA~~/E

Certificates of experience of vehicle lift mechanics employed to install, supervise and test the system shall certify mechanics to have not less than 5 years experience installing, supervising and testing vehicle lifts of the type and rating specified. Certificate shall certify that vehicle lift system installer is acceptable to manufacturer, prior to installation of system.

SD-10 Operation and Maintenance Data

Vehicle Lift System; G A/E

Six copies of operation manual outlining the step-by-step procedures for installation, system startup, operation, maintenance, safety, and shutdown. Manuals shall include manufacturer's name, model number, service manual parts list and brief description of all equipment, including basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Manuals shall include equipment layout and complete wiring and control diagrams of the system as installed. Operation and maintenance manuals shall be approved prior to training course.

1.3 QUALIFICATIONS

The vehicle lift manufacturer shall be ISO9001 certified. The vehicle lift shall be third party certified by ETL Testing Laboratory and shall display the ETL/ALI (Automotive Lift Institute) label that affirms conformance to all applicable provisions of ANSI/ALI/ALCTV-1998. The manufacturer shall either install the vehicle lift system or provide a letter of endorsement certifying that the system installer is acceptable to the manufacturer.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variations; and dirt, or other contaminants.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field and advise the Contracting Officer of any discrepancy before performing any work.

1.6 WARRANTY

Warranty service shall be provided for each vehicle lift for a period of 12 months after date of acceptance by Contracting Officer. Warranty service

shall be performed only by trained mechanics during regular working hours, and shall include manufacturer's warranty requirements including but not limited to adjusting, labor and parts needed to keep the vehicle lift in proper operation. Testing and adjustments shall be in accordance with the applicable provisions of ALI.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Material and equipment shall be the standard products of manufacturers regularly engaged in the fabrication of vehicle lifts, and shall essentially duplicate items which have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is available 24 hours a day, 7 days per week, with a response time of 4 hours. Replacement parts shall be available from a nationwide network of factory designated parts facilities.

2.1.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, and electrical and mechanical characteristics on a plate secured to the item of equipment.

2.1.3 Special Tools

One set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall be provided.

2.1.4 Electrical Work

Changes to the electrical distribution system required for coordination with vehicle lift equipment shall be performed and coordinated by the Contractor, at Contractor's expense. Electrical work shall conform to requirements in Section 16415 ELECTRICAL WORK, INTERIOR.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Structural Steel

Structural steel shall be hot-rolled commercial quality carbon steel, pickled, oiled, complying with ASTM A 569/A 569M and ASTM A 568/A 568M.

2.2.2 Cold-Rolled Sheet Steel

Sheet steel shall be cold-rolled commercial quality low-carbon steel, Class 1, exposed matte finish, oiled, complying with ASTM A 366/A 366M and ASTM A 568/A 568M.

2.3 GENERAL SPECIFICATIONS

This specification is based on Rotary Lift Model SL29, two-post inground, drive through, frame contact lift.

Rise: 1984 mm.

Width Overall: 2273 mm.

Drive-Thru Clearance: 2019 mm.

Reach Min/Max: 622 mm/1083 mm.
Adapter Height: 114 mm.
Low Step Height: 168 mm.
High Step Height: 257 mm.
Capacity: 4082 kg.
Guide Piston Diameter: 165 mm.
Motor: 1.5 kw.
Voltage: 208-230V
Speed of Rise: 55 sec.

2.4 VEHICLE LIFT COMPONENTS

2.4.1 Jacking Units

Each jack shall have removable plunger guide with two replaceable bearing liners. Bearing liners shall be designed to snap into position at the top and bottom of the guide. Bearing liners shall provide minimum plunger to bearing friction for smooth operation and the bearings spaced to insure maximum rigidity and support for design loads. Zerk fittings shall be located at floor level to provide adequate lubrication to guide barrel assembly.

Each plunger shall be manufactured of steel pipe, and accurately turned and polished over its entire surface to a micro finish. Each plunger shall have a protective coating to resist rusting or discoloration.

Plungers shall be attached to equalizer to prevent rotation, ensuring proper alignment of superstructures at all times. Plungers shall be removable for inspection and/or replacement.

Each plunger shall contain one 1700 mm stroke hydraulic cylinder with manual air bleeder located on the upper end of the cylinder. The rod diameter of the cylinder shall not be less than 38 mm with a cylinder bore of not less than 50 mm. Each hydraulic cylinder shall be designed with a restrictor orifice to regulate the lowering speed, so as not to exceed 20 feet per minute.

Each jack shall have (two) wiper assemblies- prevents entry of dirt into bearing area.

2.4.2 Arm/Adapter Assemblies

Shall consist of four telescoping swing arm assemblies. Each arm assembly shall have an adapter base, which is laterally adjustable and equipped with a rotating, 3-height vehicle contact adapter. The vehicle contact adapter shall be capable of accommodating optional adapters for special lifting applications. Optional adapters must fit over the standard adapter and held in place with a non-removable detect pin.

2.4.3 Wheel Spotting Dish

A floor mounted, three position wheel spotting dish shall be supplied to facilitate the proper vehicle position and proper load distribution on the lift.

2.4.4 Containment System

The container shall be made of thick, chemically compatible, low-density polymer composite and sized to house the lift frame assembly. Lift frame

assembly shall be capable of being removed and relocated. The containment lid shall consist of a removable non-skid coated cover plate with watertight seal between lid and lift frame. Provide lid of sufficient strength to support a wheel loading of one quarter of the design capacity without permanent deformation. Watertight entry boot shall be provided for a 50 mm PVC hose chase.

2.4.5 Locking Mechanism

Lift assembly shall contain a locking latch mechanism, which automatically sets at 75 mm increments after the first 175 mm of travel, continuing through full rise. The locking latch system shall have a single point switch, air actuated release located near the power unit controls for operator convenience. The latch shall automatically reset when the latch switch is released. There shall be no less than 16 locking positions per lift assembly.

2.4.6 Mechanical Lifting and Equalization System

The lift shall be equipped with a positive mechanical equalization system to keep both sides of the lift level at all stages of travel. The equalization system shall consist of a rigid channel frame bolted to the plungers.

2.4.7 Power Unit

The power unit shall be self-contained with 2hp, 208 volt single phase 60 hz motor. Fluid system shall have a capacity of 12.3 L. Controls shall be "dead-man" type push button up and joystick style lowering lever for descent.

2.4.8 Paint Finish

General: Comply with NAAMM AMP 500 Manual for recommendations for applying and designating finishes. Provide powder-coated finish on steel components, unless noted otherwise. Immediately after cleaning and pretreating, apply manufacturer's standard, thermosetting polyester or acrylic urethane powder coating with a cured film thickness not less than 1.5 mils (0.04 mm). Color and gloss shall be manufacturer's standard colors.

2.4.9 Certificate Frame

A stainless steel certificate frame with translucent plexiglass lens of the appropriate size to receive certificate issued by inspecting agency shall be provided for vehicle lift. Frame shall be engraved to show name of lift manufacturer, carrying capacity in kilograms and pounds.

2.5 LUBRICATION POINTS

Every part subject to movement friction shall be complete with provisions for oil and grease lubrication.

PART 3 EXECUTION

3.1 INSTALLATION

Vehicle lift and equipment shall be installed in accordance with ALI and manufacturer's recommendation, by an insured factory trained and authorized installer. Equipment shall be thoroughly cleaned before lift is put into

operation. During installation, painted steel surfaces shall be protected. Scratched or marred surfaces shall be restored to original condition.

3.2 FIELD WELDING

When structural or load-bearing members are to be field-welded, welding and qualification of welders shall be as specified in Section 05120A STRUCTURAL STEEL.

3.3 WIRING

Wiring shall be provided for electrically-operated items of lift equipment to comply with requirements of NFPA 70 and Section 16415 ELECTRICAL WORK, INTERIOR. For control and signal circuits wire shall be minimum No. 18 AWG. Wiring shall terminate in junction boxes. Wires shall be identified and match symbols shown on wiring diagrams.

3.4 TESTING

Testing shall be in accordance with requirements of ETL/ALI and as specified below. Contractor shall conduct a complete test of the system. After the system has passed all tests, the Contractor shall notify the Contracting Officer in writing, 30 days prior to the time of performing the acceptance test, that the system is complete and is ready for final acceptance testing. The Contractor after receiving written approval from the Contracting Officer will conduct a complete acceptance test of the system. The Contractor shall provide the services of an independent testing laboratory to inspect the vehicle lift. The inspector shall meet all qualification requirements of ETL/ALI and shall be certified in accordance with ETL. The Contractor shall provide a certificate signed by the inspector. The certificate shall be provided to the Contracting Officer within 30 days after completion of all testing.

3.4.1 Testing Period

The lift shall be tested with the specified rated-load for a period of 35 percent of the duty time. During the test run the vehicle lift shall be stopped at incremental stops in both directions of travel for a standing period of 10 seconds per stop. A manual test of the final limits (UP and DOWN overtravel) shall also be performed.

3.5 FRAMED INSTRUCTIONS

Two sets of instructions shall be typed and framed under glass or in laminated plastic, and posted side-by-side near the lift where directed, before acceptance of lift system. First set of instructions shall include wiring and control diagrams showing the complete layout of lift system. Second set of instruction shall include the condensed operating instructions explaining preventive maintenance procedures, the methods for checking the lift system for normal safe operation, and the procedures for safely starting and stopping the lift system.

3.6 OPERATOR TRAINING

Contractor shall conduct a formal training course for operating Government personnel which shall include care, lubrication, adjustment and maintenance of the lift equipment. Training period shall consist of a total of 2 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. Field instructions shall

cover all of the items contained in the operating and maintenance instructions, including demonstrations of routine maintenance operations. The Contracting Officer shall be notified at least 14 days prior to date of starting the training course.

-- End of Section --

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DIVISION 14 - CONVEYING SYSTEMS

SECTION 14622

MONORAILS WITH ELECTRIC POWERED HOISTS

09/99

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SECTION 14622

MONORAILS WITH ELECTRIC POWERED HOISTS
09/99

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S329 (1985) Allowable Stress Design
Specification for Structural Joints Using
ASTM A325 or A490 Bolts

ASME INTERNATIONAL (ASME)

ASME/ANSI B30.11 (1993) Monorails and Underhung Cranes
ASME/ANSI B30.16 (1993) Overhead Hoists (Underhung)
ASME HST-1M (1989; R 1995) Electric Chain Hoists
ANSI/ASME HST-4M (1991; R 1996) Overhead Electric Wire Rope
Hoists

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A275/A275M (1996) Magnetic Particle Examination of
Steel Forgings
ASTM A325M (1993) High-Strength Bolts for Structural
Steel Joints (Metric)
ASTM A325 (1997) Structural Bolts, Steel, Heat
Treated, 120/105 ksi Minimum Tensile
Strength
ASTM A563M (1996) Carbon and Alloy Steel Nuts (Metric)
ASTM A563 (1996) Carbon and Alloy Steel Nuts
ASTM F959M (1996) Compressible-Washer-Type Direct
Tension Indicators for Use with Structural
Fasteners (Metric)
ASTM F959 (1996) Compressible-Washer-Type Direct
Tension Indicators for Use with Structural
Fasteners

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.179 Overhead and Gantry Cranes

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410

(Rev. D; Am. 1) Wire Rope and Strand

MONORAIL MANUFACTURERS ASSOCIATION (MMA)

MMA MH27.1

(1981) Underhung Cranes and Monorail
Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1

(1993; Rev. 1-4) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(1999) National Electrical Code

1.2 SYSTEM DESCRIPTION

Provide a monorail system with electric powered hoists and electric powered trolley complete, tested and ready for operation. Monorails, hoists, trolley, equipment, materials, installation, examination, inspection, and workmanship shall be in accordance with the applicable requirements of NFPA 70, ASME/ANSI B30.11, ASME/ANSI B30.16, ASME HST-1M, ANSI/ASME HST-4M, and MMA MH27.1, with modifications specified herein. Reference in these publications to the "authority having jurisdiction" shall be interpreted to mean the "Contracting Officer."

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

*8

SD-02 Shop Drawings

Monorail system; G, A/E

SD-03 Product Data

Monorail track system including switches, suspension system and other components; G, A/E

Electric wire rope hoist; G, A/E

Electric chain hoist; G, A/E

Trolley; G, A/E

Pendant pushbutton station; G, A/E

Electrification; G, A/E

SD-05 Design Data

Load and sizing calculations; G, A/E

SD-06 Test Reports

Wire rope breaking strength test; G, A/E

Load chain proof test; G, A/E

Hook and hook nut magnetic particle inspection; G, A/E

Post-erection inspection; G, A/E

Operational tests; G, A/E

Hook test; G, A/E

No-load test; G, A/E

Load test; G, A/E

Rated load speed test; G, A/E

SD-07 Certificates

Bolts; G, ~~REA/E~~

Nuts; G, ~~REA/E~~

Washers; G, ~~REA/E~~

Painting system; G, ~~REA/E~~

Overload test certificate; G, ~~REA/E~~

SD-10 Operation and Maintenance Data

Overhead monorail system, Data Package 3; G, A/E

Submit data package in accordance with Section 01781N, "Operation and Maintenance Data."

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, including subfreezing temperatures, precipitation, and high winds. Store materials susceptible to deterioration by direct sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on ground. When special precautions are required, prominently and legibly stencil instructions for such precautions on outside of equipment or its crating.

1.4.2 Handling

Handle materials in such a manner as to ensure delivery to final location in undamaged condition. Make repairs to damaged materials at no cost to Government.

1.5 QUALITY ASSURANCE

1.5.1 Certificates: Overload Test Certificate

Submit a statement that the monorail system can be periodically load tested to 125 percent (plus 5 minus 0) of rated load.

1.5.2 Drawings: Monorail System

Show the general arrangement of all components, clearances and principal dimensions, assemblies of hoist, trolley, track, track suspension system, and electrical schematic drawings.

1.5.3 Design Data: Load and Sizing Calculations

Submit calculations verifying the sizing of any track, track suspension device and additional supports which are not the monorail system manufacturer's standard cataloged product.

PART 2 PRODUCTS

2.1 OVERHEAD MONORAIL SYSTEM

Provide overhead monorail system conforming to MMA MH27.1, Class C, for indoor and outdoor service, with an electric wire rope or chain hoist mounted on a movable trolley. Trolley shall be motor operated. Monorail system shall operate as recommended by manufacturer, 60 Hz, single phase power source.

2.1.1 Capacity

The monorail system shall have a minimum rated capacity of 2.3 metric tons. Mark the hoist capacity in kg on both sides of the hoist or load block.

2.1.2 Speeds

The hoist shall have two operating speeds and shall be capable of hoisting and lowering the rated load at a high speed of 100 mm/s. The trolley shall have two operating speeds and shall be capable of moving the rated load at a high speed of 500 mm/s. Low speed(s) shall be one quarter to one third of high speed(s). Actual speed(s) shall be within plus or minus 15 percent of those specified.

2.1.3 Material Limitations

Shafts, keys, couplings, sprockets, and chains shall be steel. All gears shall be steel except for worm gears, which shall be bronze or steel. Cast iron and aluminum used to support components of the hoist power transmission train shall be ductile.

2.1.4 Safety

Comply with the mandatory and advisory safety requirements of ASME/ANSI B30.11, ASME/ANSI B30.16, and 29 CFR 1910.179.

2.2 MONORAIL TRACK SYSTEM

MMA MH27.1. Track beams shall be patented track sections fabricated by a manufacturer regularly engaged in production of this type of beam.

2.2.1 Track Suspension System

Monorail suspension shall be flexible type. Make bolted connections to supporting structure, excluding hanger rods, with ASTM A325M bolts, ASTM A563M nuts, and ASTM F 959M load indicator washers. ASTM A325M bolts shall be fully pre-tensioned in accordance with AISC S329. Support monorail track system from the structural members shown. Provide additional supports as required to carry monorail track system loads to the structural members shown. Materials for additional supports shall conform to the material requirements contained in Section 05120N, "Structural Steel."

2.3 ELECTRIC WIRE ROPE HOIST

ANSI/ASME HST-4M, Class H3, except as modified herein. Hoist shall be double reeved.

2.3.1 Hoisting Ropes

FS RR-W-410, improved or extra improved plow steel, regular lay, uncoated, 6 by 37 class construction, with an independent wire rope core. Provide proof of wire rope breaking strength test report.

2.3.2 Sheaves

Sheaves shall be steel or ductile cast iron. Pitch diameter of running sheaves shall not be less than 16 times the rope diameter. Pitch diameter of non running sheaves shall not be less than 12 times the rope diameter.

2.3.3 Drum

Drum shall be steel or ductile cast iron. Pitch diameter of the drum shall not be less than 18 times the rope diameter. Not less than two dead wraps of the hoisting rope shall remain on each anchorage when the hook is in its extreme low position.

2.4 TROLLEY

Trolley shall meet all applicable requirements of MMA MH27.1, ASME HST-1M and ANSI/ASME HST-4M. Trolley shall have elastomeric bumpers to engage runway stops.

2.5 MOTORS

NEMA MG 1. Hoist and trolley motors shall be single speed AC squirrel cage induction type. Trolley motor shall be single speed AC squirrel cage induction type. Motor insulation shall be Class B minimum. Provide totally enclosed non-ventilated (TENV) motor enclosures. Maximum motor speed shall not exceed 1800 RPM.

2.6 CONTROLS

Provide single speed magnetic control for the hoist and trolley. Provide single speed magnetic controls for the trolley. Provide reduced voltage starting, acceleration and deceleration for the trolley drive.

2.7 LIMIT SWITCHES

Provide upper and lower limit switches which de-energize the hoist motor.

2.8 BRAKES

Provide hoist with an electro-mechanical holding brake and a mechanical load brake, each capable of holding 130 percent of the rated hoist capacity. Hoist holding brake shall be capable of being released to test the load brake. Provide trolley with an electro-mechanical brake. Provide trolley brake with a minimum torque rating of 100 percent of the drive motor rated torque. Trolley brake torque shall be adjustable down to 85 percent of its torque rating.

2.9 LOAD BLOCK AND HOOK

Construct load blocks of steel. Provide forged steel, swivel type hook, with hook nut keyed to hook shank by means of a setscrew installed in a plane parallel to the longitudinal axis of the hook shank, or other similar easily removable securing device. Provide hook with spring loaded steel safety latch for closing the hook throat opening. The hook and hook nut shall be unpainted. Permanently mark hook and hook nut with an identification number.

2.9.1 Hook and Hook Nut Magnetic Particle Inspection

Magnetic particle inspect the hook and nut over the entire area in accordance with ASTM A275/A275M. Acceptance standard shall be no defects. A defect is defined as a linear indication that is greater than 3 mm long whose length is equal to or greater than three times its width.

2.10 BEARINGS

All bearings except those subject to a small rocker motion shall be anti-friction type. Bearings not considered lifetime lubricated by the manufacturer shall be provided with a means for lubrication.

2.11 PENDANT PUSHBUTTON STATION

Hoist and trolley shall be controlled from a pendant pushbutton station. Arrange pushbuttons in accordance with ASME/ANSI B30.11 recommendations. Locate station 1.2 m above the finished floor.

2.12 ELECTRIFICATION

Runway electrification shall be of the flat festooned type. Provide electrical work for the monorail system in accordance with NFPA 70 and Section 16402N, "Interior Distribution System".

2.13 IDENTIFICATION PLATES

Provide identification plates of noncorrosive metal with clearly legible permanent lettering giving the manufacturer's name, model number, capacity in pounds, and other essential information or identification.

2.14 PAINTING SYSTEM

Painting shall be manufacturers standard. Provide a primer and a finish coat. Blast clean all components prior to painting. Primer shall be inorganic zinc type. The finish coat shall be an epoxy formulated for marine environments. Paint coats shall be smooth and even, free of runs, sags, orange peel, or other defects.

PART 3 EXECUTION

3.1 ERECTION AND INSTALLATION

Erect and install the monorail system, complete in accordance with the approved submittals and in condition to perform the operational and acceptance tests.

3.2 ERECTION SERVICES

Provide supervisory erection services from the monorail system manufacturer.

3.3 FIELD QUALITY CONTROL

3.3.1 Post-Erection Inspection

After erection, the Contractor and the Contracting Officer shall jointly inspect the monorail and hoist systems and components to determine compliance with specifications and approved submittals. The Contractor shall notify the Contracting Officer 5 working days before the inspection. Provide a report of the inspection indicating the monorail system is considered ready for operational tests.

3.3.2 Operational Tests

After erection and inspection, test the hoist, and trolley as specified herein. Test the systems in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacturer, installation, and workmanship. Rectify all deficiencies disclosed by testing and retest the system or component to prove the monorail system is operational. The Contractor shall furnish loads for testing, operating personnel, instruments, and all other necessary apparatus.

3.3.3 Test Data

Record test data on appropriate test record forms suitable for retention for the life of the monorail system. Record operating and startup current measurements for electrical equipment (motors and coils) using appropriate instrumentation (i.e., clamp-on ammeters). Compare recorded values with design specifications or manufacturer's recommended values; abnormal differences (i.e., greater than 10 percent from manufacturer's or design values) shall be justified or appropriate adjustments performed. In addition, high temperatures or abnormal operation of any equipment or machinery shall be noted, investigated, and corrected. Record hoist and trolley speeds during each test cycle.

3.3.4 Hook Test

Measure hook for hook throat spread before and after load test. Establish a throat dimension base measurement by installing two tram points and measuring the distance between these tram points (plus or minus 0.4 mm). Record this base dimension. Measure the distance between tram points before and after load test. An increase in the throat opening by more than 5 percent from the base measurement shall be cause for rejection.

3.3.5 No-Load Test

- a. Hoist: Raise the load hook the full operating lift distance and

verify satisfactory operation of hoist, upper limit switch, lower limit switch, and the hoisting and lowering speeds. Operate the hoist at low and high speed in both directions.

- b. Trolley: Operate trolley assembly the full length of the monorail in both directions. Operate trolley at low and high speed in each direction. Verify satisfactory operation and verify trolley speed. Operate all rail switches.

3.3.6 Load Test

125 Percent (plus 5 percent minus 0) of rated capacity

- a. Hoist Static Test: Raise test load approximately one foot above the floor and hold for 10 minutes. Observe load lowering that may occur which will indicate malfunction of hoisting component or brake. Lower the test load to the floor until the hoist line is slack.
- b. Hoist Dynamic Test: Raise the test load to approximately 1.5 m above the floor using both speed points in the process. Lower the load back to the floor using both speed points. Stop the test load at least once while lowering at high speed and observe proper brake operation. Wait 5 minutes, then repeat the above cycle.
- c. Load Brake Test: Raise test load approximately 1.5 m. With the hoist controller in the neutral position, release the holding brake. The load brake should hold the test load. Again with the holding brake in the released position, start the test load down at low speed and return the controller to off position as the test load lowers. The load brake should prevent the test load from accelerating. NOTE: It is not necessary for the load brake to halt the downward motion of the test load.
- d. Loss of Power Test: Raise the test load approximately 1 m and while lowering test load at low speed, cut main power to hoist. Load should stop.
- e. Trolley Test: With test load hoisted to a height of 300 mm above the floor, operate trolley the full distance of the monorail in both directions using both speed points in the process. Observe for any malfunctioning of the trolley assembly and monorail system. Operate all rail switches.

3.3.7 Rated Load Speed Test

With the hoist loaded to rated capacity, raise and lower the load verifying that the hoisting and lowering speeds are provided as specified. With the hoist loaded to rated capacity, operate trolley along the monorail beam verifying that the trolley speed is provided as specified. Further, verify that the trolley stops in each direction within a distance (in feet) equal to 10 percent of rated capacity high speed (in feet per minute) when initially travelling at high speed and carrying the rated capacity load. Record voltage, amperage, hoisting and lowering speeds, trolley travel speed, and motor speed for each motor.

-- End of Section --